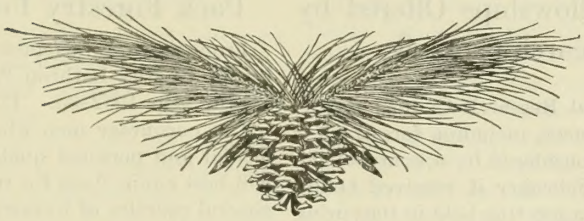
FOREST WORKER



November, 1931

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UNITED STATES DEPARTMENT OF AGRICULTURE

CONTENTS

Announcements

Forest Research Fellowships Offered by National Research Council

Applications for National Research Council fellowships in the biological sciences, including forestry, for the year 1932–33 will be considered by a board of the council the first week in February if received before December 15, 1931, and at a meeting held in the spring if received between that date and March 15, 1932. The fellowships are open to citizens of the United States and Canada, of both sexes, who possess the Ph. D. degree or have done work equivalent to that required for the degree. The purpose is to promote fundamental research through the development of thoroughly trained investigators. At present it is the board's policy to restrict appointment to applicants in the early stages of a research career who have demonstrated ability of a high order and who give promise of developing individual judgment and point of view in investigative work. Appointments are for one year only, but may be renewed. The choice of place to work rests with the fellow, subject to the approval of the board. The basic stipends awarded per annum are $1,800 for unmarried fellows and $2,300 for married fellows in America, and $1,800 and $2,400, respectively, with additional travel allowance, for unmarried and married fellows appointed to study in Europe.

Requests for further information in regard to these fellowships should be addressed to the Chairman, Board of National Research Fellowships in the Biological Sciences, National Research Council, Washington, D. C.

Pack Forestry Fellowships Available

From six to eight fellowships are available for award by the Charles Lathrop Pack Forest Education Board for the year 1932–33. The purpose of the fellowships is "to encourage men who have shown unusual intellectual and personal qualities to obtain training that will best equip them for responsible work either in the general practice of forestry, in the forest industries, in the teaching of forestry, in forest research, or in the development of public forest policy." No restrictions are made as to age, educational status, or practical experience; ordinarily, however, fellowships will be granted only to those who have completed an undergraduate college course or its equivalent, and only to American or Canadian citizens. Grants may be made for study at a school of forestry or an institute of research, on a forest under management, in association with forest industries, or in travel. In general, the grants will range from $500 to $1,800.

Applications must be made to the secretary of the board, at 1214 Sixteenth Street, Washington, D. C., by January 1, 1932. The prescribed application form will be mailed by the secretary on request.

Pacific Science Congress Postponed

The Canadian National Research Council has announced that on account of the disturbed conditions prevailing throughout the world the Government of Canada has deemed it best to postpone for a year the Fifth Pacific Science Congress, which was to have been held under the council's auspices May 23–June 4, 1932, in Victoria and Vancouver, British Columbia.

The Forest Worker is published by the Forest Service, United States Department of Agriculture, Washington, D. C. Jean Kerr, editor. Material offered for publication in the Forest Worker should be addressed to the editor.

Because the free edition is necessarily limited, this periodical can be distributed without charge outside of the Government service only to such persons and organizations as State forestry and conservation officials, State agricultural extension directors, faculties and libraries of forest schools, and forestry associations. Others desiring to obtain copies of the Forest Worker can do so by sending 5 cents for a single copy or 25 cents for a year's subscription to the Superintendent of Documents, Government Printing Office, Washington, D. C. Foreign subscriptions: Yearly, 35 cents; single copies, 7 cents.

FOREST WORKER

Washington, D. C. NOVEMBER, 1931 Vol. 7, No. 6

State Forestry

Control Measures Against Forest Insects

By HENRY B. PEIRSON, State Entomologist, Maine

Ten years of experience in forest insect control work carried on by the Maine Forest Service has repeatedly confirmed the belief that insect outbreaks, like fire, can be controlled if located in time.

Maine was the first State in the Union to start a fire-lookout service, and the system has been built up so that to-day practically all of the 15,000,000 acres of forest land in the State is covered by lookouts and patrolmen. With this efficient, well-established service already on the ground it has been just another step forward to organize the men to report on insect outbreaks. By means of illustrated booklets, personal contact, and the finest of cooperation from the men in the field, promising results are being obtained.

The men are furnished with addressed mailing tubes in which to mail specimens, and report blanks that cover the points essential to a satisfactory diagnosis of the reported outbreak. It has been found that personal contact with the men, showing them in the field the different types of insects and their work, is the most essential part of the project. This phase of the work must be continually followed up.

Local outbreaks can almost invariably be controlled by cutting the timber on the infested areas or, in favorable cases, by spraying. The present year has seen local outbreaks of several foreign pests which are being stamped out before they assume epidemic form.

In one case an entire town is cooperating through town funds, the local nursery, and private estate owners. Outbreaks of native insects which are likely to prove serious are being controlled largely through cutting. This would be impossible were it not for the interest shown by the lumber and pulp companies and other landowners. Outbreaks are carefully scouted and reports with recommendations sent to the owners of the property. Almost invariably these recommendations are followed.

Widespread outbreaks that have invaded Maine from the Canadian Provinces or from the other New England States are being combated by the use of parasites, spraying, and embargoes. The Maine Forest Service maintains a laboratory where parasites are raised and where life-history and control studies are carried on. Each year sees new methods of control worked out.

There are many old beliefs in regard to insect outbreaks that must gradually be changed in the minds of technical foresters and others whose work carries them into the woods. The forest schools of the country could do much in correcting these falsities and in building up a basic working knowledge of insect control. There is always a reason for outbreaks starting, and under proper forest management many of these causes can be eliminated. Observations indicate that outbreaks invariably start up in isolated spots and not simultaneously over wide areas as is so often believed, although a single year may see many small outbreaks of the same insect.

Many persons believe that insect outbreaks after starting up run for a few years and then die down naturally. This belief has probably done more harm than any other one factor, for it has a tendency to cause people to look on an outbreak as a storm that can not be stopped. Outbreaks do not stop without some reason, such as lack of food, climatic conditions, parasites, or control measures employed by man.

The average annual loss from forest insect outbreaks in Maine has been approximately $3,000,000, according to an estimate based on the very lowest of stumpage valuations. It is believed that this loss can be brought down to a very low figure and kept there. The adoption of forest insect control work by all States would, it is believed, greatly reduce the Nation's forest insect losses, now estimated at about $150,000,000 yearly, and by utilizing the fire-prevention systems which the States and the Federal Government already have in operation the cost of the work could be kept very low.

Plantings of black walnut have failed nine times out of ten in Pennsylvania, where the species has been planted extensively, according to conclusions reported by Thomas C. Williams, assistant forester, Sproul forest district. Field studies by the Pennsylvania Department of Forests and Waters have shown clearly that only the very best soils will produce successful black walnut plantations, and that the planting should be confined to fertile agricultural valleys in the southern and eastern sections of the State.

Wisconsin's Cooperative Plan for Stabilizing Lumber Industries

By Bernard Frank, United States Forest Service

"Regular employment of seasonal workers in the logging industry and the steady employment of workers normally employed in saw mills are among the first responsibilities of the lumber industry, and are of vital importance not only to the industry but to those who earn their living in other industries, to taxpayers, and to the State. Steady employment, the rational use of natural resources, fair practices and reasonable profits, and social and political stability, would be promoted by better planned and more orderly production. As a first step toward more orderly production, manufacturers of lumber in Wisconsin sign this agreement and invite the cooperation of the State on the terms herein set forth.

"* * * We, therefore, agree one with the other, not for the purpose of price fixing or individual commercial advantage, but for the reasons above stated, that for the period between July 1, 1931, and July 1, 1932, the production of each one of us will not exceed 28 per cent of our average annual production for the years 1927, 1928, and 1929."

So reads in part a recently approved contract between the State of Wisconsin and the hardwood and hemlock producers, marking a further advance in the efforts of a "socially minded" State toward the cooperative stabilization of its industries. It is the outcome of conferences between the governor and leading lumbermen extending over the past 10 months.

The need is obvious. A shutdown of the mills in any community would have serious economic and social consequences. Despite curtailment of production by Wisconsin and Michigan mills in 1930 and the first half of 1931, mill stocks on July 1, 1931, were 111 per cent of those on July 1, 1930. The aggregate shipments for the 12 months ending June 30, 1931, were lower than those for any similar period on record. At the current rate of shipment the present supply of either hemlock or hardwoods, which amounts to 150 per cent of the past year's production, is sufficient for two years.

The fulfillment of the terms of the contract is being supervised by a committee of seven representative lumbermen headed by O. T. Swan. An advisory committee of five has been approved by the Wisconsin Department of Agriculture and Markets, with the following membership: A. J. Altmeyer, secretary, State industrial commission; Harry Jerome and Chris L. Christensen, University of Wisconsin; Louis Schreiber, banker; and Hawley Wilbur, retail lumberman.

Current statistics on production, shipments, and market conditions are made available to the executive committee to enable it to adjust production either upward or downward. The advisory committee will see to it that no unreasonable practices in restraint of trade are instituted. "Whenever, in the judgment of this committee, the common and public interests are not being promoted by the operation of the agreement, the committee shall have power, after consultation with the committee of seven, by written notice to members of the committee of seven, to declare it at an end and withdraw the cooperation of the State."

The participants in this agreement include a majority of the lumbermen in Wisconsin, representing more than 75 per cent of the State lumber production by volume.

While this action involves only a small fraction of the total national lumber output, as an experiment in applying to the lumber industry the principles of planned production it has unquestionable significance.

Blue-Ribbon Plots

Blue "ribbons" of paint are being used to mark the trees chosen to form the final timber crop on certain areas of the Connecticut State forests. The practice was adopted this year on the suggestion of Joseph S. Illick, now professor of forest management in the New York State College of Forestry, who recalled that bands of yellow paint are used to mark the crop trees on the Heidelberg Communal Forest, Germany. It has been put into effect on 14 or 15 plots of ½ to 1 acre each on State forests and on 6 plots on private timberland holdings. In each case from 50 to 100 trees per acre have been chosen to be left standing until they reach an age of about 100 years. After the banding of the crop trees the plots have been thinned so as to give these trees better conditions for development, and future thinnings or other cultural operations will be carried out with the same purpose. Rather complete measurements have been made on the crop trees, and the plan is to repeat these measurements periodically.

It is planned to put up a sign along the road at each of these plots for the information of the public. The plots stand out very strikingly as seen from the road, and it is hoped that they will have an effect in leading private timberland owners to adopt the practice of selecting crop trees.

The State forestry department offers to examine an acre of forest chosen by any fire warden and if a sufficient number of the trees meet its requirements to establish a plot and band the trees with blue paint. In such cases the owner is required to agree that he will leave the blue-ribbon trees standing long enough to permit measurement of five years' growth.

Trees grown in the Idaho State forest nursery that were sold in 1931 for use in establishing farm woodlands, shelter belts, and windbreaks numbered 75,000, of which 44,000 were black locust and 9,760 were Siberian elm.

Oregon Enlarges Forestry Appropriations and Legislates for Reforestation of Tax-Delinquent Lands

Oregon forestry appropriations approved in 1931 for the coming year total $133,800, including an addition of $16,000 for the administration of the State reforestation law and for educational work.

Legislation of the year provides that counties may transfer to the State title to forest lands that have been foreclosed for taxes and on which the required redemption period has expired. The State undertakes in such cases to pay the county an annual fee of 5 cents per acre while the land is reforesting and 12½ per cent of the gross revenue from the land. (These are the tax rates established by the Oregon reforestation law.) The remaining revenue will revert to the school fund. Another new law gives the governor power during periods of extreme drought to close forest areas to all forms of use or to forbid entry to such areas except under permit binding the entrant to comply with certain fire-prevention regulations. This measure replaces a law, recently declared unconstitutional, which permitted the governor to close the hunting season during periods of excessive fire danger.

Michigan Forest Tax Law Amended

Michigan's commercial forest reserve act of 1925, which provides for special taxation of lands stocked with immature forest growth and devoted to the production of merchantable timber, has been amended effective September 15, 1931, so that its provisions may now be brought to bear on lands that, although not sufficiently well stocked with young timber growth to meet the requirements of the law if considered by themselves, are essential to the proper development of forest property accepted for listing under the law. The severance tax on the products of land listed under the law is reduced, also, from 25 per cent to 10 per cent of the stumpage value of the timber removed.

The requirement that a fee of 5 cents per acre per year be paid when lands are withdrawn from classification now applies regardless of how long the land has been classified, and to this is joined a 10 per cent yield tax. Formerly, a fee of 10 cents per acre per year in addition to the basic 5-cent fee was required if land was withdrawn 15 to 25 years (inclusive) after classification, and in lieu of these two fees a 30 per cent stumpage tax was levied if the withdrawal took place 26 years or longer after classification.

Additions to the original act give the landowner the privilege of appealing to the circuit court from any decision made by the department of conservation under the act; allow the owner free use of wood cut for domestic purposes; give the conservation department access to the lands and to books of the operator for the purpose of determining the accuracy of reports on cutting; and give the owner the right to withdraw without penalty in case the fees or taxes are so changed as to increase his burden.

A few weeks before the amendments to this law became effective the acreage listed under the law totaled 72,701. At that time the department of conservation had rejected applications for the listing of 68,441 acres and was considering applications covering approximately 20,000 acres.

New Fire Equipment for Wisconsin

Orders and requisitions for 14 new forest-protection trucks and 22 gasoline power water pumpers were issued in 1931 by the Wisconsin Conservation Commission, with the expectation that the new equipment would be available for use during the fall fire season of this year. One half-ton truck was ordered for each of the 11 forest-protection districts. Three 1½-ton trucks were ordered to fill the quota of at least two trucks of this type for each of the forest-protection districts, which average 1,200,000 acres. The new gasoline power pumpers, of which two were ordered for each district, are of two sizes, with capacities of 47 gallons and 88 gallons, respectively, per minute. Some of these are replacements.

Another order was for 36,800 feet of 2½-inch hose, to be distributed among the districts.

A unit consisting of a truck motor, a 300-gallon-per-minute centrifugal pump, and a trailer was ordered by the commission for use in fighting peat fires. It is so designed that there can be one outlet carrying 1,500 feet of 2½-inch hose, or two outlets each of which supplies water to 750 feet of 2½-inch hose. It is possible also by the use of reducing Siamese couplings to take two leads of 1½-inch hose from the end of each of the other leads. Throughout the peat districts there are drainage ditches from which this unit can be supplied with water. The unit will be stationed between districts 10 and 11 in the central part of the State and will be used in both districts.

In addition to this motor equipment, the State's increased forestry appropriation enabled the commission to order several hundred additional hand tools in time for the fall season.

The Georgia Forest Service has announced the formation this fall of the Big Bend Timber Protective Organization, embracing 35,000 acres in Charlton County, and the Kinderlou Timber Protective Organization, embracing 17,500 acres in western Lowndes County.

Attala County, Miss., has been added to the area protected from forest fire by the Mississippi Forest Service in cooperation with landowners and counties. The county contains 359,000 acres of potential forest land.

Hemlock Deaths in Pennsylvania Attributed to Drought

Many hemlock trees have died in Pennsylvania during the past year, report George S. Perry and J. N. Knull, of the Pennsylvania Forest Research Institute, who attribute the deaths largely to the 1930–31 drought. The loss appears to be heaviest on red shaly slopes in Perry, Juniata, Snyder, and Union Counties, where on many areas with a southern exposure more than nine-tenths of the hemlock trees are dead. Trees are dying also in shallow soil on warmer sites in Pike, Monroe, and Luzerne Counties. Even in the Black Forest region—Potter, Lycoming, Elk, and McKean Counties—"where hemlock originally was at its best," small hemlocks have died and many hemlocks have dead tops.

In most woodlands and forest areas the trees were not observed to be dying during 1930. The theory that drought was the chief cause of the deaths is compatible with this fact because the foliage of evergreens is slow to change color or drop following the death of the trees, and also because trees weakened but not killed by drought are subject to the attack of the spotted hemlock borer and may die of the combination of the two causes years after the drought occurs.

Two conclusions may be reached, say Messrs. Perry and Knull: "(1) Hemlock is a tree primarily suited to cool, moist soils, which in the better second growth forests occurs on northerly slopes and sheltered valleys. (2) Because hemlock once flourished on given areas does not indicate that it will grow there successfully now. Recurrent forest fires, open exposure to sun and wind, with completely changed vegetation and soil litter conditions, very often render sites far less acceptable to this sensitive tree than was the case in the original forest."

Citizens and organizations of Berks County, Pa., have already planted 1,232,543 trees, which they plan to dedicate next year as George Washington Bicentennial trees. The 160 agencies and individuals reporting bicentennial plantings include churches, schools, Boy Scout organizations, hospitals, and garden clubs.

Taylor County, Wis., has dedicated a George Washington Memorial Forest of 1,600 acres, near Medford, Wis. The land was deeded to the county especially for this purpose. About 75,000 Norway pine and northern white pine seedlings were planted this fall on 120 acres of the tract, and trees will be planted on the remainder as funds become available. As a feature of the dedicatory exercises the first of the memorial trees was planted by E. L. Urquhart, the 85-year-old chairman of the Taylor County board, who logged over that part of the country about 50 years ago.

Illinois County Forests

By Lewis B. Springer, Illinois Division of Forestry

The forest preserve act of Illinois, passed about 1913, provided a way for counties to acquire small or large tracts for recreational purposes. Several counties, including Cook, Will, Du Page, Kane, and Winnebago, have taken advantage of this law and, altogether, the plan is working out well to supplement State and municipal forests.

Cook County took advantage of the act about 1914. Its forest preserve district now consists of about 34,000 acres of picturesque woodlands, with lakes, rivers, hills, and bridle paths, encircling the entire city of Chicago, and provides outdoor recreation for all who care to use it. Visitors total five or six million yearly. Every available form of outdoor entertainment is provided for in the preserves. There are camping facilities, swimming, fishing, boating, bathing, athletic fields, tennis courts, and picnicking spots; concrete roads winding in and out through the various tracts; drinking fountains, comfort stations, and shelters. Baseball diamonds are laid out in nearly every section, and golf links are being constructed as fast as the demand requires. Tempting trails lead into the heart of the preserves. The preserves are used in the winter months as much as in summer, providing skating on the river, tobogganing, and snowshoeing. A new ski slide has been built at Palos, just west of Swallow Cliff.

The Cook County preserves are rich also in historical background. The Palos hills contain the ruins of French forts established in the days when the French explorers and their soldiers were contesting with the Indians. There are ruins of Indian villages throughout the Desplaines River Valley. The Portage Preserve marks the spot where Indians and French voyageurs launched their canoes, and on the beautiful Beverly Hills section the Indians once maintained a signal tower More than a hundred years ago this playground was a battlefield.

The people of Winnebago County voted in 1922 to establish a forest preserve district. The county now has eight forest areas of good size, including Hononegah Park, Laona Heights, Sugar River Preserve, Kilbuick Bluffs, and Kishwaukee Bluffs on both banks of the Kishwaukee River. Visitors to the Winnebago County forest preserves in 1930 numbered 750,000, and it is estimated that in 1931 they have exceeded 1,000,000. Tauge G. Lindquist, a forestry graduate of the Michigan Agricultural College, is forester of the Winnebago County forest preserves, with headquarters at Rockford. Mr. Lindquist has a county nursery that ranks with many State nurseries. Operating expenses and the financing of purchases of new land are provided for by a ½-mill tax.

Kane, Will, and Du Page Counties have county forests totaling several hundred acres, organized and managed in much the same way.

Forest Fires of 1930

In the calendar year 1930 forest fires burned over 5,809,320 acres of the land in the United States[1] for which fire protection was provided by the State governments and by the United States Forest Service, according to a summary of reports made by State foresters and national forest supervisors. This constitutes 1.46 per cent of the total area, 399,141,870 acres, so protected during the year.

Land in need of fire protection but not protected during 1930 amounted, according to the estimates of State foresters, to 208,779,060 acres. Of this area, it is roughly calculated, fires during 1930 burned over about 46,457,000 acres.

Direct damage by forest fires was officially estimated at $14,597,280 on protected areas and at $51,371,070 on unprotected areas.

When the fires of 1930 on protected lands were classified according to reported cause, smokers were again indicated as the leading cause, being held responsible for 17,460 fires. The number of fires reported as of incendiary origin mounted to 14,394, as compared with an average of 7,638 so reported for each of the five years 1926–1930. Fires reported as caused by débris burning totaled 9,180, or 3,578 more than the 5-year average. It was reported that lightning caused 5,217 fires on protected land; campers, 5,011; railroads, 4,625; and lumbering, 1,626. Fires on protected land that were listed as of unknown origin totaled 6,332.

Los Angeles County Forestry in 1930–31

The Los Angeles County Forestry Department during the fiscal year 1930–31 operated on budgets materially reduced below those of the preceding year, but received a special appropriation of $25,000 to assist in relieving unemployment. Men employed with this appropriation did excellent work for the reduction of fire hazards on mountainous public roads and in maintenance of firebreaks, reports County Forester Spence D. Turner.

Forestation work carried out by the department during the year included six experimental plantings and only two general field plantings, about 27,000 trees of 50 different species being used. The experiments begun during the year have to do with species, size, and age of stock, types of planting, and differences in elevation, site, and exposure. Some plots of selected native brush species were started and some direct seeding was done. Trees distributed to individuals for planting on major watersheds totaled 21,676.

Ornamental forestry work of the department during the year included trimming 44,685 trees on county highways. Mistletoe-eradication operations by the department at Big Pine Camp, under appropriations made available in 1930 by the board of supervisors, involved work on 2,279 oaks and 610 pines and the felling of 135 trees.

Records of the number of days per month on which the relative humidity was below 30° indicated that the lowest humidity prevailed in the months of October, November, December, and March.

During the year the department acquired two fire trucks having 250-gallon water tanks and two with 600-gallon tanks, and equipped all division squad trucks with 120-gallon water tanks in unit with Barton pumps. It also installed twelve 5,000-gallon water tanks at advantageous locations on brush-covered areas throughout the county where water was not immediately available. A lookout tower was constructed on county property on Pacoima Peak.

Near the city of Griffin, in Spalding County, Ga., is a plantation of loblolly and shortleaf pines which increment borings have shown to be about 35 years of age, reports Assistant State Forester E. B. Stone, jr. A recent cruise of the plantation showed 17,544 board feet of pine and 1,500 board feet of red gum to the acre, indicating that the average yearly growth per acre has been 544 board feet.

Savannah, Ga., has been selected as the site for the paper research laboratory for which the Chemical Foundation of New York has contributed $50,000 and the Georgia Legislature has appropriated $40,000 to be used in 1932 and 1933. Charles H. Herty will direct the work of the laboratory.

Through a succession of years during which acorns from one *Quercus nigra* only have been planted in certain seed beds of the Louisiana State forest nursery there have developed in these beds a number of seedlings having the typical leaf form of *Quercus phellos* and *Quercus laurifolia*, reports Charles Delaney, who has done the planting. Some of these seedlings have been under Mr. Delaney's observation for as long as five years, and have preserved their diverse leaf characteristics to that age.

North Carolina has abandoned the system of maintaining different deer and squirrel hunting seasons in different parts of the State. The uniform seasons now fixed are September 15 to January 1 for deer and September 1 to December 31 for squirrel. The season for taking fur-bearing animals including mink, skunk, otter, and muskrat has likewise been made uniform throughout the State, extending from November 15 to February 15. Raccoon and opossum may be hunted with dogs and gun beginning October 1.

[1] Figures given in this article are for continental United States exclusive of Alaska. Figures for areas protected or needing to be protected from fire include together with forested lands other lands, intermingled with or adjoining them, fires on which would endanger forests.

State Forests for Watershed Protection

Reporting for the Connecticut Geological and Natural History Survey on an investigation of the potable water resources of the State, made in pursuance of an act of the Connecticut General Assembly approved in 1925, Roscoe H. Suttie, associate professor of civil engineering in Yale University, wrote in part as follows:

As our cities increase in population it will be necessary for them to obtain their water supplies from more and more distant watersheds. Eventually private companies may not be able to acquire all of the land necessary for watershed protection or to police it properly. There are at present thousands of acres of rough land unsuited for farming or suburban development which, properly forested and under public control, could be made to serve for watershed protection. The timber produced on these areas would help meet the impending timber shortage. The State now owns approximately 36,000 acres of forest lands. To complete the program as outlined by the Connecticut State Park and Forest Commission requires the purchase within a few years of 200,000 acres more. There is no incompatibility between State forests and watersheds for water supply.

The advantages of State forests in providing part of the lumber needs and wild life protection are well understood. The advantages of State forests as a safeguard for water supplies are not as much appreciated. State forests will not only protect against pollution but also equalize stream flow, diminish the violence of freshets, increase low water flow, and prevent erosion and silting of the streams.

Two hundred thousand acres so located as to furnish drainage area and storage for water supply would provide a supply for about 1,500,000 additional people * * *.

In consideration of purchase areas for the State forests, future water supply might well be given weight.

Education and Extension

Michigan State College Measures Growth of Planted Conifers

Data on the growth rates of planted western yellow pine, northern white pine, and Norway spruce, and on the spacing desirable for trees of these species, have become available to the Michigan State College of Agriculture because of a planting made at the college in 1914 for the purpose of holding very sandy soil in place. The classes of stock planted were as follows: Western yellow pine, 2-year seedlings; northern white pine, 6-year transplants; and Norway spruce, 4-year transplants. The spacing was 4 feet by 4 feet. Moisture conditions differ greatly from the bottom to the top of the slope on which the trees were planted. When R. H. Westveld, assistant professor of forestry in the college, measured about 100 trees of each species in 1930, he obtained the following averages:

	Western yellow pine	Northern white pine	Norway spruce
Total height in feet:			
Lower slope	21.7	23.3	21.8
Upper slope	18.7	19.6	11.1
Diameter at breast height in inches:			
Lower slope	4.4	4.0	3.0
Upper slope	*4.1	3.4	2.1

In 1930 the maximum diameters for the three species were as follows: Western yellow pine, 6.9 inches; northern white pine, 7.2 inches; Norway spruce, 4.9 inches.

The western yellow pine had developed wider-spreading crowns than the other species. The trees of this species were crowding each other to such a degree that some of them had already died and a thinning was needed, especially on the lower slopes. The Norway spruces had developed narrow crowns that as yet were not crowding each other, and would not need a thinning until at least 1935. The northern white pine showed a crown development intermediate between those of the two other species.

Farm Forestry in Northern New Hampshire

A farm forestry survey of Coos and Grafton Counties, N. H., has been made by Assistant County Agent C. S. Herr and has led him to the following conclusions:

Woodland composes 52 per cent of the average northern New Hampshire farm in comparison with 18 per cent devoted to crops and 30 per cent to pasture. Of the average farm income 24 per cent is directly attributable to the wood lot, as compared with 40 per cent obtained through the dairy industry. The average annual farm income includes $570 derived from the direct sale of wood products and together with this an indirect income from the wood lot amounting to $152. Spruce and fir make up 55 per cent of the timber on the average northern New Hampshire wood lot.

Formation of a forest protective association in Searcy County, Ark., is reported by Extension Forester Charles A. Gillett. Approximately 150 residents have become members, pledging themselves to protect their woodlands from forest fires. The association will carry on educational work designed to reduce the number of forest fires.

Extension Foresters of Nine States Meet at Ithaca

On September 1, 1931, extension foresters of nine States met at Ithaca, N. Y., at the invitation of Extension Forester J. A. Cope, to spend two days in the field inspecting results of Mr. Cope's work. They were accompanied by Lincoln C. Kelsey, State county agent leader, and by H. H. Horner, assistant commissioner of the New York State Department of Education. In the two days the party visited nine forest management and planting demonstrations, a State game refuge that is being planted with trees as a typical example of the reforestation of abandoned farm land, and one of the State parks.

One 8-acre farm woodland seen has supplied 30 short cords of fuel wood per year for the past 20 years; that is, a little more than 1 standard cord per acre per year. The owner is justifiably proud of the money return he has obtained from the land and of the present condition of the woods. Other exhibits were a planting of 10,000 black locust trees all showing excellent growth as a result of field crops having been grown on the land the first year; planted pines and hardwoods on steep and rough parts of a farm where a farm bureau forestry committeeman is setting an example to his neighbors; a black locust plantation 17 years old that has produced an excellent crop of fence posts, the returns averaging about $5 per acre per year; and a 50-year-old Norway spruce plantation that has produced an average of 1½ cords of peeled wood per acre per year. On the second day the visitors saw a result demonstration by Donald J. and Lawrence J. Davidson, 4-H forestry club boys living in Delaware County who have completed the four years of forestry club work consisting of tree planting, forest appreciation studies, woodland management, and timber estimating. In Sullivan County they got a first-hand view of the profitable commercial forestry operations of George I. Treyz, who for the past 18 years has used the clear-cutting system in harvesting some 200 acres of timber yearly for sawlogs and distillation wood.

Registration at the New York State College of Forestry this year reached a new total of 398, including 136 freshmen, 95 sophomores, 99 juniors, 41 seniors, and 27 graduate students. The marked change in the ratio of juniors to seniors (last year the registration in these two classes was 74 and 71, respectively) is explained by the adoption of higher standards of admission to the senior class.

Twenty-seven forestry seniors of the Iowa State College of Agriculture spent more than two months of the past summer on the Deschutes National Forest, Oreg. Professors Jeffers and Horning were in charge. The boys camped at Paulina Lake and made trips to practically all parts of the forest, particularly to the various logging operations. They helped fight a major fire (Tom Butte), and after the fire mapped the burned area and made a fire-damage cruise of it.

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The School of Forestry of the University of Idaho has been elected to membership in the International Union of Forest Research Organizations. It is the eighth institution in the United States to enter this union, which has as its aim the promotion of international cooperation in the various branches of forest research.

Fifty-eight new students were enrolled in the forestry division of the University of California in the fall semester of 1931, bringing the division's total registration to 120. Of the new registrants 18 were graduate students and 14 were juniors.

A course in camp leadership is offered by the newly organized department of forest recreation and park engineering of the New York State College of Forestry. The course will be given by Fay Welch, who has had extensive experience in conducting camp-leadership courses at Columbia University and elsewhere and in directing summer camps for children.

Charles H. Herty is offering prizes totaling $175 to be awarded on the basis of forestry work of Georgia rural vocational schools during the present school year. An award of $100 is to be made to the school taking first rank in forestry work, and first and second prizes of $50 and $25, respectively, will be awarded to individual students.

Two 4-H forestry club boys of Scott County, Iowa—Kenneth Rueffer and Grover Hahn—won first place over all other agricultural demonstrators at the Mississippi Valley Fair and Exposition at Davenport, Iowa, with their booth and demonstration "Tree Planting is a Part of Erosion Control." Later they took their booth and demonstration to the Iowa State Fair and in competition with teams in poultry, livestock, dairy, and apiary work won first place in demonstration and third place for the booth. In the same class Horace New and Robert Proctor, of Story County, demonstrating windbreak tree planting, won first place for their booth and third place for the demonstration.

Forest Service Notes

Segregation of Sheep and Cattle on National Forest Ranges in Arizona

By Paul H. Roberts, United States Forest Service

The policy of segregating sheep and cattle on the Sitgreaves, Coconino, and Tusayan National Forests, in Arizona, was established by the Forester in 1925. Prior to that time the range had for the most part been utilized in common by the two classes of stock. Serious damage to forage plants and young trees, particularly western yellow pine seedling, was occurring as a result of overgrazing. Under the system of common use of the range it was not possible to fix responsibility for damage upon either class of stock. In order to relieve the overgrazing and the resultant damage to forage plants and trees the Forest Service had first planned to make material reductions in the numbers of stock using the forest ranges. Severe reductions were vigorously opposed by the stockmen, who had heavy investments in ranch headquarters and range improvements and to whom such reductions would, in many cases, mean financial loss. The segregation policy was decided upon by the Forest Service as a means of bettering range conditions while avoiding as far as possible severe reductions in numbers of live stock.

Control of livestock on the ranges was the first requisite of the new system. Sheep could be confined to designated areas by herders. To restrict cattle to their established allotments, however, required that controlling influences such as available water, forage requirements, and natural barriers be supplemented through the construction of many miles of drift fences between sheep and cattle ranges and of boundary fences to prevent stock on outside areas from drifting onto the national forests. Adjustments necessitated by segregation were worked out, fencing proceeded rapidly, and by 1927 the system was largely in effect. The adjustments were made in time to afford material protection to much of the yellow pine reproduction resulting from the heavy 1919 seedling crop. Refinements have been made annually since that time. Reductions have in some cases been made as first planned; in many cases it has been found that the reductions planned could be materially modified or that they were in fact unnecessary.

Important results of the system are as follows:

1. Control of stock on definite areas, the first essential of range management, has been brought about.

2. Control of the number of stock using a given range area, a second essential, has been very much improved.

3. Distribution of stock on the range is much improved. Concentration of large numbers of both classes of stock around particularly favorable permanent waters during dry periods is prevented.

4. Proper seasonal use can be obtained, through the construction of a comparatively small quantity of cross-fencing or through methods of management.

5. Administrative difficulties have been materially lessened. The permittee has an individual interest in his range, and is held responsible for conditions existing thereon. He therefore in most cases is amenable to measures designed to keep his range in good condition and obviate the necessity of reductions in numbers of stock, and voluntarily adopts such measures.

6. The old system of imposing blanket reductions in numbers of stock allowed to use the range, as a measure for the prevention of damage to trees and forage plants, which resulted in organized resistance by large numbers of stockmen, has been made unnecessary. Except in cases of cattle on community ranges, necessary reductions are now imposed on the individual allotment or permittee.

7. There is a general recognition by stockmen of the benefits to be derived from assignment to individual ranges, and a distinct tendency has developed on the part of the stockmen to favor breaking up large community cattle ranges into individual allotments.

Improvement in condition of forage and tree growth as a result of segregation has been far greater and more rapid than advocates of the system expected. In spite of the severe drought conditions that prevailed for several seasons, in general the recovery of damaged tree reproduction and forage cover has been remarkable. The numerous advantages of segregation under the present degree of refinement of range management more than outweigh any arguments for dual use in the Southwest. It may be that in the future it will be found advisable to rotate classes of stock on certain areas to provide for satisfactory utilization of some forage species that are not utilized by one or the other class of stock. Such species tend to crowd out herbaceous growth palatable to the class of stock on the range or to grow in such abundance as to constitute a distinct fire hazard.

Chemical analysis of samples of sweet birch collected at various times during the 1930 season on the Tahoe National Forest, Calif., showed that the percentage of protein decreased and the percentage of nitrogen-free extract and fat increased with advancing stages of maturity. The percentage of phosphorus declined steadily as the season advanced. The calcium content was found to have increased markedly between August 2 and August 21, which was about the time when cattle were observed to leave the birch browse.

Mixed Stands Produce Pine Lumber of Higher Grade

By Benson H. Paul, United States Forest Service

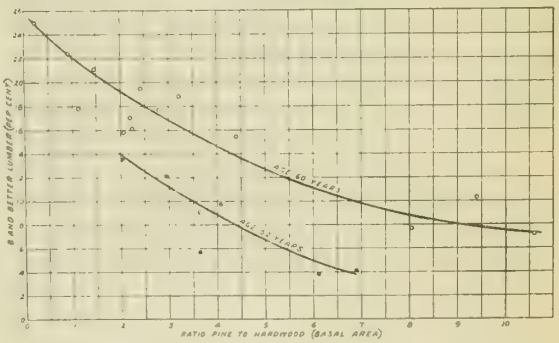
If a second-growth southern pine stand contains a substantial mixture of second-growth hardwoods of about the same age as the pine, a higher proportion of the lumber is in the best grades than if the pine stand had contained relatively few or no hardwoods in mixture, the Forest Products Laboratory has found.

The hardwoods exert a beneficial influence in causing an earlier natural pruning of the stems of the young pine trees. The broad-leaved trees cast a heavier shade than the pines and as a result hasten the death of the lower pine branches while the latter are yet of small diameter. The small dead branches soon break off and fall to the ground, leaving the lower portion of the pine stem smooth and clear of branches. When the irregularities left by the fallen branches have been covered over by the growth of the tree, the wood of subsequent growth is clear and free from knots.

The development of mixed stands of hardwoods and pines in the southern pine region has been hindered in two general ways. First, the grass fires which often burn through the forests kill back all hardwood trees to the ground, whereas many of the pine trees, on account of their thicker bark, are able to resist the heat and survive. Under such conditions pine forests are likely to be open and understocked and, owing to the many branches of the trees, to produce only low-grade lumber. The second circumstance that hinders the growth of hardwood trees in second-growth pine stands is a very dense initial seeding of the ground with pine. Because the hardwoods start more slowly than the pine, dense seeding with pine prevents them from making satisfactory headway. In such a case the pine trees, although they may prune themselves fairly well, are too close together for satisfactory growth, and unless the stand is thinned the individual trees remain small and for very many years do not attain a size sufficient to allow the separation of the thin, clear outer stem portion from the inner portion containing knots, in the manufacture of lumber.

Studies recently made in loblolly pine forests showed that the highest lumber values were derived from stands in which from 20 to 25 per cent of the timber consisted of second-growth hardwoods well distributed among the pines. Under these conditions the hardwoods helped to produce a more open stand of pine, by separating the pine trees, and assisted in the removal of lateral branches from the pines by shading the lower portions of their trunks. The hardwoods, although of the same age as the pine trees, were not so tall as the pines, and this gave the upper portions of the pine-tree crowns abundant room for development.

The accompanying curves show the relation in two 60-year-old stands and one 52-year-old stand between the percentage of B and Better lumber cut and the basal-area ratio of pine to hardwood trees in the stands. In these stands, it was found, the percentage of B and Better lumber increased definitely as the proportion of hardwood trees increased. In general, however, according to the results of logging and milling studies conducted by the Forest Products Laboratory, the net value per acre of the stand is greatest in cases in which the ratio of pine to hardwood is about 4 to 1. A greater proportion of hardwoods results in a lower production of pine lumber and a smaller net value per acre, since the hardwood lumber is less valuable than the pine. With more valuable hardwood species or



CURVES SHOWING RELATION OF PRODUCTION OF B AND BETTER LUMBER TO THE RATIO OF PINE AND HARDWOOD IN SECOND-GROWTH LOBLOLLY PINE STANDS

better hardwood markets this condition might be altered to some extent.

Other advantages accrue from growing hardwoods in mixture with pines. Hardwood leaves decay more readily than the resinous needles of pines and restore plant foods to the soil more quickly. Also, by absorbing and holding moisture the hardwood leaves assist in bringing about the disintegration of the pine needles and the formation of humus. Thus mixed stands maintain the forest soil in a more productive condition. In Europe for many years the cultivation of an understory of beech has been practiced as a means of maintaining soil fertility in coniferous stands.

Seed beds at the Feather River nursery of the California Forest Experiment Station that were treated with flour sulphur last year showed practically no losses from root rot during the season, whereas beds not so treated showed losses from this cause amounting to 21 per cent in western yellow pine and to 26 per cent in Jeffrey pine. The sulphur was used at the rate of one-half pound to 10 square feet of seed bed. In seed beds of western yellow pine and Jeffrey pine that were treated with a zinc sulphate solution (13 ounces in 6 gallons of water) immediately after they were sown and covered, a check at the end of May showed only about one-third as many weeds as in untreated beds and a check in the middle of June showed only one-half as many weeds as in untreated beds.

Forest Homesteads 24 Years After

By L. F. Kneipp, United States Forest Service

National forest officers of the Intermountain Region[2] have reported on a survey made in 1930 of national forest lands listed under the forest homestead act of June 11, 1906. This act provided for the classification, survey, and opening to entry of all lands within the national forests chiefly valuable for agricultural purposes and not needed for more important public purposes. The survey was confined to existing national forest lands, excluding areas eliminated from the forests since 1906. The figures given under different classifications do not seem to balance, but they broadly picture the trends of the forest-homestead policy. The high lights are as follows:

	Acres
Areas listed:	
Total	242, 078
Patented	152, 590
Pending entries	4, 812
Unentered	46, 107
Lists recalled	38, 569
Present agricultural use:	
Cleared	45, 185
Cultivated	28, 671
In orchard	234
In fenced pasture	75, 100
In unfenced pasture	27, 457
Unused	25, 940
Present occupancy of listed areas as homes:	
Original entryman—	
Yearlong	17, 768
Summer	8, 010
Succeeding entryman—	
Yearlong	3, 102
Summer	2, 366
Purchaser—	
Yearlong	20, 346
Summer	11, 083
Unoccupied as homes	94, 727
Present ownership of areas unoccupied as homes:	
Entryman	35, 115
Other farmer	15, 583
Stockgrower	28, 520
Public utility company	1, 743
Hotel, resort, or summer home	503
Mine operator	237
Bank or trust company	5, 375
Counties (through reversion)	4, 371
Unknown	3, 279
Present use of areas not occupied as homes:	
Farming and related grazing	25, 766
Grazing only	48, 559
Recreation	553
Mining	20
Unused	19, 828
Reasons for abandonment as homes:	
Inferiority of soil	2, 954
Soil exhaustion	1, 076
Lack of market	651
Better opportunities elsewhere	33, 850
Other	56, 195

The cost of the improvements on the listed tracts, exclusive of sawmills, stores, dance halls, swimming pools, and other structures not truly essential to land settlement and cultivation, is estimated at $922,992. Probably this estimate takes into account part of the labor of the homesteaders. It does not, however, represent the collective thousands of years of human life and hope and fear expended in the process of settlement, nor does it include the scores of thousands of dollars expended from the Federal Treasury in examining, classifying, reporting on, and surveying the listed areas.

The Intermountain Region perhaps more than any other in the West contains a population essentially agrarian in nature and tendencies, a class of people better qualified and more disposed than the average to overcome the difficulties of homesteading. It is more than probable that the results of similar surveys in other regions would be even less encouraging. Some day, when there are fewer fires and timber sales and land exchanges, these other regions should size up the homestead situation in a comparable way.

[2] The Intermountain Region includes Utah, southern Idaho, western Wyoming, Nevada, and northwestern Arizona.

Two Extremes of Forest Soil in Southeastern Alaska

By R. F. Taylor, United States Forest Service

In a region where two tree species commonly form in mixture 95 per cent of the forests, it would seem probable that one common soil type would be most desirable for the growth of either species. In southeastern Alaska Sitka spruce and western hemlock form in mixture about that percentage of the forests but individually thrive best on types of soil that are far from similar.

The more desirable Sitka spruce, favored by the Forest Service in natural regeneration, is seldom found in pure stands over large areas except on lands recently uncovered by glacial recession. The everpresent hemlock occurs in pure stands on the poorest sites, on which raw humus and a thick podsol layer are characteristic. Young hemlock stands are apt to stagnate, and mature ones are less productive than mixtures of spruce and hemlock.

Sample quadrats and belt transects show that the optimum soil type for Sitka spruce reproduction consists of glacial silt and gravel lightly covered by a mold formed of the débris of pioneer plants, mostly willows, alders, and poplar. The character of this soil is good, but the quantity is not sufficient for fast growth. Hemlock and spruce germinate with the first pioneers, the hemlock dies out by the twentieth year, and a pure stand of spruce results. Such stands are commonly understocked and slow growing. The soil type most favorable to pure hemlock stands lacks mineral soil and hardwood leaves. It consists of rotten wood, ericaceous débris, undecayed litter, and raw humus. It shows a podsol horizon. On this soil both species germinate but hemlock is usually the lone survivor. Between these two soil types lies the happy medium for the species mixture.

Just what feature of the glacial soil prevents the competition of the hemlock is not known, nor do we know why spruce can not tolerate an excessively acid nonmineral soil. In investigations of soil conditions on yield study plots it has been found that the sites having the fastest growth show a mixture of the two species in which spruce forms at least 50 per cent by basal area, a soil cover passing through a normal process of decay, and a very thin podsol layer.

Having considered the two extremes, one might prescribe a mixture that should prove enticing to the desired Sitka spruce. To 5 parts of mineral soil add 3 parts of forest duff and humus and 2 parts of alder mull. Mix well and allow to lie in the sun. Such a mixture is often found on cut-over land along the logging roads and at the foot of slides. It produces young stands having a high percentage of spruce and faster growth than anything observed on other soil types. A thorough tearing up of the soil in logging should do much toward producing faster-growing stands having high percentages of spruce.

Results of Girdling to Release Pulpwood Timber Pay Costs in Two Years

Girdling of hardwoods to release pulpwood timber of merchantable size on an area in northeastern Maine has brought about a net profit of $2 per acre for each of the 11 years since the girdling operation, according to an estimate by Marinus Westveld, of the Northeastern Forest Experiment Station. The operation was carried out in 1919 in a typical mixed spruce and northern hardwood stand on property of the Eastern Manufacturing Co. near Patten, Me. Girdling of all hardwoods with breast-height diameters of 2 inches or more released on each acre 40 spruces and firs having an average diameter of 8 inches and an average volume of 272 cubic feet (2.8 cords). In 1930 the plot showed 1,050.4 cubic feet (11 cords) of merchantable pulpwood per acre; without the release operation, Mr. Westveld estimates, the yield would have been only 412 cubic feet (4.3 cords) per acre. Even during the first four years following the girdling, the pulpwood timber showed a growth greater by 115.2 cubic feet (1.2 cords) per acre than could have been expected without the release operation. During that period the number of merchantable trees increased to 160 per acre.

In the 11-year period following girdling the annual growth of the pulpwood timber per acre showed a 5-fold increase—from ⅓ cord to ¾ cord.

The results of this experiment indicate that the costs of girdling hardwoods to release pulpwood timber of merchantable size in the Northeast may be more than repaid by the additional growth put on by the latter in the first two years following the girdling operation. Thus a very short lapse of time may bring to an end the danger that the investment in the release operation will be lost through the necessity of cutting the timber because of fire or other damage.

Southern Woods for Paper Pulp

By Parker K. Baird, United States Forest Service

Since the beginning of 1930 about one-third of the activities of the pulp and paper section of the Forest Products Laboratory have been devoted to problems related to the utilization of southern woods. This work has been made possible through a special congressional appropriation.

Ever since the advent of wood into the pulp and paper industry as a substitute for rags, spruce has been king of the pulp mill. Now, however, his dethronement is under way and a democracy of pulpwood species is about to be declared. Research to determine the suitability of other woods for pulping has had the result that in spite of the cutting of great quantities of pulpwood in the United States our potential pulpwood stands are to-day more extensive than they were 20 years ago.

The principal pulp product of the South at present is of the kraft type, as produced by the old standard process. It is best fitted for such products as brown wrapping paper, bag paper, container board, and similar products. Inasmuch as the kraft process is alkaline, no difficulties due to resins and pitch are involved in pulping longleaf pine by this process. Standard kraft is very difficult to bleach, however; consequently strong white or light-colored papers can not be made from it. It can now be said that the South dominates the American kraft pulp industry.

The lower cost of wood in the South permits cheaper pulp production. In the past this advantage has been offset to some degree by the fact that papers made from southern tree species have not been quite up to the quality of those made from northern or imported species. This inferiority has been due to the nature of the fibers in the southern pines and also to the lack of technical control in the processing, which has resulted in a somewhat weaker and "wilder" sheet of paper. These characteristics are gradually being overcome, and eventually just as good paper should be made in the South as anywhere else. As soon as the South is able to make kraft paper of the same color and strength as that which is now being imported from Europe at the rate of 1,200 tons per day, apparently there will be no obstacle to its meeting in full the national demand for this commodity. So long as kraft pulp is the only paper product of the South, however, the situation will be economically dangerous; the South needs a diversified pulp industry.

About four years ago Congress made a special appropriation to the Forest Products Laboratory to investigate the pulping qualities of southern woods and particularly the possibilities of developing a strong, white paper from the southern yellow pines. The resulting investigations, confirming previous work, showed that southern yellow pine reduces to pulp best by the sulphate process. The sulphite, or acid pulping process,

was found unsuitable for virgin longleaf pine. No marked success resulted from an attempt to grind longleaf pine for mechanical pulp.

In testing the kraft process on longleaf pine it has been found that increasing the proportion of cooking chemical to wood and using a greater proportion of cooking liquor than was previously employed results in a high yield of pulp that can be bleached, by a special process, without much loss in strength. This finding has been of decided value and is now used by one of the leading paper companies in the South.

Shortleaf pine can be used to make high-grade kraft wrapping paper, fiber board, and book stock. Very little experimental work has been done on shortleaf pine with any pulping process other than the standard kraft process.

Loblolly pine was the first of the southern pines on which pulping experiments were carried out at the Forest Products Laboratory. It was on this species that the first studies toward producing an easily bleachable kraft pulp were made. Strong white pulps suitable for bond, book, and other high-grade papers were obtained from loblolly, and it is understood that at least one southern mill is now using large quantities of this pulpwood in its mills and incorporating it in a book and bond sheet as a substitute for the spruce sulphite pulp formerly used. The mechanical pulping characteristics of loblolly pine are only fair, and much power is required to produce the pulp. This problem is being studied. Certain other characteristics, such as color, may require special consideration in the production of groundwood pulp from loblolly pine.

In the recent Forest Products Laboratory studies of the pulping qualities of southern pines special emphasis has been placed on slash pine. Several interesting and important developments have occurred in the pulping of slash pine by the standard pulping processes and also by modifications of the standard processes. It has been found that second-growth slash pine, which has very little heartwood, produces a pulp of excellent bleaching characteristics when treated by the modified kraft process developed by the laboratory. A bleached sulphite pulp suitable for bond and other white papers is produced from young second-growth slash pine by the standard sulphite process. Newsprint sheets containing 90 per cent of groundwood or a 50-50 mixture of groundwood and sulphite have been produced experimentally by the laboratory from young second-growth slash pine, which consists almost entirely in sapwood. There are indications that a new combination of pulping processes recently developed by the laboratory, in which impregnation with semichemical liquors precedes the standard lime sulphite cook, will make possible the satisfactory pulping of woods with a considerable proportion of heartwood.

Following the study of pine, experimental work has been done in the pulping of black and tupelo gum, including the use of special semipulping methods developed at the laboratory. Contrary to views previously held, the sulphite process works very satisfactorily on black and tupelo gum unless much dark-colored heartwood is present, yielding a fairly strong pulp that bleaches easily to an excellent color. Most book papers contain bleached spruce sulphite along with soda pulp usually made from aspen. Sulphite in this combination gives a blue-white tint that the paper trade desires. It seems logical that book paper may be made from the pines combined with gums and certain other southern hardwoods. Long-fibered pine pulp can take the place of spruce sulphite, and gum sulphite can replace soda pulp, so that the desirable white color can be obtained. Recently excellent mechanical or groundwood pulp has been produced from gum, which together with other long-fibered pulps such as slash pine sulphite have produced excellent rotogravure and book paper.

A word of caution is in order in regard to projects directed toward the utilization of resinous woods. For many years the paper industry has been bothered periodically with pitch trouble on the paper machine. This has occurred even with spruce wood. The exact cause of pitch trouble on the paper machine has never been ascertained. Small pitch particles agglomerate and form larger ones, which, upon coming through with the fibers, may stick to the wire or couch rolls and produce holes in the paper or break it down entirely, bringing the operation to a halt until they are removed. The shut-down of a paper plant for one hour a day as a result of such troubles may mean the difference between profit and loss. Before it is attempted to initiate the manufacture of these experimental papers on a production basis, therefore, we believe it advisable to make a full mill-scale run for a considerable length of time on the new cooking and grinding process developed at the laboratory.

The development of the pulp and paper industry in the South during the past few years has been exceedingly rapid. The strange thing about this development is that it has been so long coming. Apparently the delay has been due to the conservative attitude of the paper manufacturers in not wanting to work with woods other than the familiar spruce until they are forced to from economic considerations. Not only does the South now contain a vast reservoir of pulpwood, but conditions in the region are favorable for maintaining this supply perpetually. The South is capable of reproducing stands of wood suitable for pulping purposes in approximately 25 years, a rate impossible elsewhere in the country except in the Pacific coast region.

The Forest Products Laboratory is continuing its technical pulping studies dealing with certain peculiarities of longleaf, loblolly, and slash pine. It plans also to initiate studies on the suitability of additional southern species such as sand pine and shortleaf pine for pulp manufacture, to make further fundamental

chemical studies on the nature and distribution of resins and pitch in the pines, and to attempt to eliminate resin and pitch as a paper-making nuisance.

Technique of Tapping Pines for Heptane

Experiments of the California Forest Experiment Station in tapping Jeffrey and Digger pines for heptane revealed a 17 per cent decrease in the second-year yield of mature trees. The yield of trees in the "blackjack" stage, on the contrary, increased in the second year, by nearly the same percentage. It was found that the yield varies inversely with the width of the streak, so long as the streak opens completely the plugged mouths of the resin ducts. A $\frac{1}{16}$-inch streak accurately made will open the ducts; with the hacks now available, however, the average workman can not cut a streak narrower than one-fourth inch. The yield increased as the depth of the streak was increased to a maximum of one-half inch. Angle of streak was found to be unimportant.

Open cups showed consistently larger yields than covered cups, the average difference in contents being approximately twice that which could be accounted for by the inclusion of trash in open cups. The use of cup covers may nevertheless be profitable because of the expense involved in removing trash from oleoresin collected in open cups.

Faces of medium width gave the greatest yields. The yield of faces on south, west, and east exposures was about the same; that of faces on the north was only about three-fourths as great.

Larger yields attended the use of aprons attached by 1-inch roofing nails to grooves in the bark than that of aprons inserted in ax cuts.

The tapping operation was not followed by intensification or concentration of beetle attack on tapped trees.

The cost of making 1,000 board feet of Douglas fir timber into logs is twice as great if the trees cut are only 20 inches in diameter at breast height as if they are 58 inches in diameter at breast height, according to the results of a Forest Service study involving an analysis of 300 Douglas fir trees on representative lumbering operations. Bucking costs showed a slight increase as diameters went above 48 inches, owing to increased breakage, which in many cases necessitates two or three extra cuts to eliminate shattered portions. In small trees breakage is less of a factor because it occurs principally above the merchantable top.

The California Forest Experiment Station reports that the 1931 crop of sugar pine seed is the heaviest since 1920. In most localities in California white fir and western yellow pine have failed to produce seed this year.

More About Gas from Trees

By R. R. Reynolds, United States Forest Service

The presence of inflammable gas in trees is a phenomenon not exactly new to foresters, although there may be a few who still "have their doubts." But the average man new to the woods would be about ready to streak for home if he were to observe some of the "gas attacks" during the increment boring of hardwoods in various parts of the South in connection with studies by the Southern Forest Experiment Station.

During timber growth studies in Hempstead County, Ark., in the summer of 1931, out of a total of about 100 bottom-land hardwoods measured and bored, at least 22 showed the presence of gas. In eight instances the gas emitted by these trees was plentiful enough to burn when a lighted match was applied at the handle of the increment borer.

In two different trees the gas was under such pressure that it came out literally "with a bang." The first time this happened, it so startled the man doing the boring that he jumped away from the tree. The noise sounded like the discharge of a Benjamin air rifle and was heard by another member of the party at a distance of 60 feet. When a lighted match was held to the head of the increment borer through which the gas was issuing the gas immediately caught fire. The flame, which was pale blue in color, shot out about 5 inches beyond the end of the instrument and burned for about two minutes. During this time a cigarette was lighted from it.

In this instance the tree was a willow oak (*Quercus phellos*). Gas was found to be present in different individuals of three other oaks (*Quercus nigra*, *Q. lyrata*, and *Q. alba*). Also, two instances of gas were found in red gum (*Liquidambar styraciflua* L.) and one in bigleaf shagbark hickory, locally known as kingnut hickory (*Hicoria laciniosa* (Michx. f.) Sarg.).

The gas in these trees apparently was held in or came up or down the tree in a relatively small space, since working the increment borer a fraction of a turn farther into the tree stopped the escape of gas through the borer. When the handle of the instrument was returned to its former position gas again began to escape.

The nature of the gas and the cause of its formation are apparently an unsettled question. If the gas is formed through decay, as seems probable, it may be that this takes place in the roots or in the lower part of the stem, the gas then coming up through the vessels to the point at which it is tapped by the increment borer.

In the case of the willow oak just described, several borings were made around the circumference of the tree to determine whether there was any evidence of decay. Each of these borings went to the heart of the tree, and each core removed showed perfectly sound wood. In none of the other instances in which gas was observed did the cores show evidence of decay. In practically none was any evidence of decay apparent.

How to Make Photographs Identify Themselves

By C. A. Abell, United States Forest Service

In order that photographs taken in connection with forest research may be rapidly and accurately correlated with field notes, it is desirable that they include some means of identification for temporary numbering. When a great many pictures are to be made of more or less similar vegetation and the photographer is working without an assistant, such identification is practically indispensable.

A simple system that requires no special equipment was tried with satisfactory results last summer in photographing Georgia hardwoods. Each set of a dozen films was designated by a letter marked on the film box. Within the set, numbers 1 through 12 were indicated by a sheath knife stuck in one of the tree boles. The knife handle was placed in positions corresponding to hour points on a clock dial. To avoid confusion between consecutive numbers, the knife point was located differently for odd and even numbers. In picture number 1, for example, the knife point was at the edge of the visible portion of the tree trunk, but in picture number 2 it was at the center of the surface of the trunk as seen by the camera.

Other devices have been suggested such as a chart on the principle of the counting frame, or beads on a string. The use of these devices, however, would involve adding another piece of equipment to the already overflowing camera case, whereas the system just described enables the photographer to obtain the same result through the use of an inconspicuous article ordinarily at hand as a part of his personal equipment.

Northern White Pine Stumpage Prices in the Northeast, 1926–1930

By Henry B. Steer, United States Forest Service

Many inquiries have been received by the Forest Service concerning the effect of the present depression on stumpage prices, particularly on prices of northern white pine in New England. The opinion has been expressed locally that, owing partly to the general economic depression and partly to the competition of cheap box lumber from the Pacific Northwest, northern white pine stumpage values in New England have suffered a serious setback.

In this connection data on actual stumpage sales of northern white pine in New England and New York during the period 1926–1930, inclusive, obtained through the cooperation of the Bureau of the Census, have been compiled by the Division of Forest Economics of the Forest Service. These data were collected in precisely the same manner in each of the five years mentioned. They cover all the white pine reported to the Forest Service as sold in the seven States in each of the five years either in pure stands or in mixed stands in which the northern white pine was treated as an individual species.

A few sales of virgin timber were reported, but it is estimated that at least 95 per cent of the timber involved was second growth.

The data on sales of northern white pine in the New England States and New York during the years 1926–1929 are summarized as follows:

	Number of sales	Volume of stumpage sold (1,000 board feet)	Value	Average price per 1,000 board feet	Range of prices per 1,000 board feet
1926	109	48,673	$424,785	$8.73	$2.00–$18.00
1927	102	44,115	418,494	9.49	3.00– 15.00
1928	121	42,240	394,912	9.35	2.75– 19.00
1929	130	50,031	394,052	7.88	2.76– 17.00

Data on such sales in 1930 are as follows:

State	Number of sales	Volume of stumpage sold (1,000 board feet)	Value	Average price per 1,000 board feet	Range of prices per 1,000 board feet
Connecticut	5	315	$1,795	$5.70	$5.00–$7.00
Maine	46	17,508	156,830	8.96	2.00–15.00
Massachusetts	37	7,136	54,433	7.63	4.00–15.00
New Hampshire	34	39,896	334,686	8.39	3.00–14.00
New York	7	313	2,604	8.32	5.00–10.00
Rhode Island	2	1,369	11,734	8.57	6.00–10.00
Vermont	10	1,882	7,885	4.19	3.00–20.00
Total and average	141	68,419	569,967	8.33	2.00–20.00

Price range class	Number of sales	Volume of stumpage sold (1,000 board feet)	Value	Average price per 1,000 board feet	Percentage of total number of sales	Percentage of volume of stumpage sold
$2–$2.99	2	80	$160	$2.00	1+	(1)
3–3.99	3	1,460	4,380	3.00	2+	2
4–4.99	9	2,154	8,686	4.03	6+	3
5–7.49	61	20,490	116,258	5.67	43+	30
7.50–9.99	35	10,851	88,985	8.20	25	16
10–14.99	28	31,574	324,098	10.26	20	46
15–19.99	2	1,760	26,400	15.00	1+	3
20–24.99	1	50	1,000	20.00	1	(1)
Total and average	141	68,419	569,967	8.33	100	100

[1] Less than one-half of 1 per cent.

Although some fluctuation is evident in yearly averages of prices received for northern white pine in the Northeast in the five years 1926–1930, the average prices received since the beginning of the general economic depression do not show a marked reduction. In 1930 only 5 per cent by volume of the white pine stumpage was sold at prices less than $5 per 1,000 feet, and 49 per cent was sold at $10 or more per 1,000 feet.

During the 5-year period there evidently was an increasing tendency in some parts of New England to cut and manufacture no white pine other than that yielding a large percentage of high-grade lumber. In other parts of New England, however, reports indicate growth of the practice of selling and manufacturing white pine as soon as the trees will produce a low grade of box lumber.

How the Southern Experiment Station Handles Pine Seed

The "standard sand flat" used by the Southern Forest Experiment Station for germination tests with seed of southern pines is a wooden box, 10½ by 10½ by 3¾ inches inside, filled with clean, moderately fine, white sand. The sand is not sterilized in any way the first time it is used. If it is to be used a second time it is heated to more than 100° C. for several hours. Except in special studies, the seed are not sterilized or otherwise pretreated. A simple device contrived by two members of the station staff, P. C. Wakeley and R. A. Chapman, makes it possible to sow the seed quickly and with certainty that the desired number go into each drill. This is a 14 by 4 inch strip of galvanized iron fitting over the flat. One edge is bent upward to form a "backstop" that prevents the seed from rolling off onto the flat. At the other edge is a slit, with edges turned downward, through which the seed, after being counted, are pressed into the drill by means of a ruler. The seed are sown 200 or 250 to a flat, 25 to a drill. Each drill is sown immediately over a ¾ by ¾ by 10¼ inch trough of 1/16-inch mesh screen wire, imbedded in the sand, which facilitates lifting the ungerminated seed for cutting tests.

The seed are covered only to a depth of one-eighth inch from their centers. Studies conducted by the station have shown conclusively that southern pine seed covered with sand or soil to a depth of one-fourth inch or more, either in flats or in nursery beds, germinate less quickly and in smaller proportions than those covered to less depth.

The wings of longleaf pine seed must be removed by hand before the tests are set up, both because of the limited size of the flats and because of the difficulty of covering the wings properly.

The seed are watered daily or as needed. The flats are examined every day, with the possible exception of Sundays during the period of less active germination. Germinating seed are pulled and recorded daily, to prevent errors arising from mortality due to damping off. Tweezers are used to raise the germinated seed. The radicle is not actually pulled out of the sand. Seed are considered to have germinated when they hump up the sand enough so that they can readily be grasped with the tweezers. A separate record is kept of each row of seed, to facilitate statistical analysis.

The individual wire drill tray, which was designed at the suggestion of Mary G. Regan, of the station staff, reduces practically to zero the loss of ungerminated seed during lifting, and reduces to 5 or 10 minutes the time required for lifting and checking the seed from one flat, which would otherwise take from 30 to 45 minutes. When the sand has been scraped away from each seed tray in turn the tray is lifted from the flat and is lowered and raised in a pail of water until the remaining sand is washed away. Such trays can be cut and folded at the rate of 50 to 80 an hour and are inserted in the sand flat with very little expenditure of time and effort.

The method used by the southern station to extract seed from longleaf and loblolly pine cones, demonstrated by E. W. Hadley in 1925, is to dry the cones in lumber dry kilns at 120° F. and from 20 per cent to 30 per cent relative humidity. The process requires 16 hours or less.

In collecting pine cones a great deal of time is saved by throwing the cones into a half-bushel basket or half-bushel measure and then pouring them into a bag instead of trying to throw them into the bag as they are gathered. This suggestion came from Superintendent Bean, of the Kirbyville State Forest, Tex.

An old idea resurrected by Nathan D. Canterbury, formerly State forester of Louisiana, is that of removing the wings from southern pine seed by wetting. Except for longleaf pine, the seed of the southern pines are so constructed that the two "claws" of the wing which grip the seed relax when wet. Instead of painfully rubbing the seed by hand, or running it through a complicated winging machine, the station's practice is to wet it thoroughly, spread it on a canvas in the sun, and either knead it in a fold of the cloth or rake it vigorously with a stick at intervals during the drying process. (Incidentally, the first rain washes the newly fallen seed of all the southern pines but longleaf free from their wings and thus not only aids their downward passage through the grass but also makes them less conspicuous to birds. This can readily be proved with a watering can and a handful of freshly extracted seed.)

A recent practical development in methods of handling pine seed that has been adopted by the southern station is the use of a cleaning mill for removing empties.

Longleaf pine seed stored in a paper bag at a temperature of 32° F. at the Southern Forest Experiment Station, New Orleans, La., germinated as promptly and as well at the end of a year's storage as fresh seed of the same lot. Within 35 days after the stored seed was sown 60 per cent of it had germinated. Seed of the same lot stored at room temperature for one year was slow in beginning to germinate and at the end of 40 days showed a germination percentage less than 25.

General Forest News

Causes of Decadence of Birch on Cut-Over Lands in New England

By Perley Spaulding, United States Bureau of Plant Industry, and H. J. MacAloney, United States Bureau of Entomology

In northern New England the cutting of merchantable timber from mixed stands often leaves a thin scattered stand of paper and yellow birch and other hardwoods. Within a few years after the cutting these residual birches decline and often die. This decadence has been attributed to the bronze birch borer, the shoestring fungus, and other causes. Studies which we undertook in 1930 to learn just what part the borer and the fungus actually play in the killing of such birches led to the following conclusions:

In the stands studied the bronze birch borer can not be considered a primary insect pest. There is ample evidence, however, that as decadence progresses the trees become more subject to attack and in many cases the borer is a contributing cause of death.

With our present knowledge the decadence of birch can not be attributed to any fungus as a primary cause. *Armillaria mellea* undoubtedly helps to destroy trees previously injured by other factors.

The yellow birches studied had been suppressed under an overmature stand for a long time. The sudden excessive opening subjected their uppermost twigs to light and heat to such a degree that the trees could not survive. The condition of the roots as revealed by our studies did not indicate marked inability to supply water, but the decided change in water conditions of the soil following the thinning may have prevented the roots from functioning to maximum capacity in dry times.

A remedy for the situation so far as it is influenced by organic factors consists in preventing mechanical injuries that would afford entry to the bronze birch borer and to *Armillaria mellea*.

In these stands the paper birch appears to have passed the age at which it could have sprouted readily. After a long period of growth decline, it was unable to come back. Its incipient decadence was aggravated by the sudden release.

It is suggested that in selective cutting none but relatively young trees be retained for future growth, especially in the case of paper birch, and that yellow birch stands be opened up only gradually. When trees to be left are selected on the basis of a diameter limit only, they may include individuals of slow growth that are too old to profit by release.

Studies of the physiological factors involved in the decadence of birch on cut-over lands have been made by R. C. Hall. In 1927 Doctor Hall began these studies in northern New England as an agent of the Bureau of Entomology cooperating with the Northeastern Forest Experiment Station. In 1929 he continued on a cooperative basis with those organizations and the University of Michigan, working in northern New England. In 1930 he continued the work in the Lake States as an agent of the University of Michigan. His results have not yet been published.

An Instance of Natural Control of the Southern Pine Beetle

By R. A. St. George, United States Bureau of Entomology

On several areas of the Pisgah National Forest, near Asheville, N. C., where second-growth shortleaf and pitch pine trees were infested with the southern pine beetle (*Dendroctonus frontalis* Zimm.), a rather heavy spring emergence of the beetle was anticipated in 1931. When I examined one of the areas on March 28, however, I found that a heavy emergence was not to take place. In fact, very few living beetles could be found. Apparently natural conditions had brought about the control of this destructive insect.

Several workers have pointed out that a deficiency of 1 inch or more in rainfall during the late summer and fall months creates conditions favorable to the increase of the southern pine beetle. Practically all epidemics of this insect in the past have occurred during periods of drought. The year 1930 will be known not only as a record-breaking drought year but also as one favorable to beetle attack. According to United States Weather Bureau records, in the vicinity of Asheville there was an accumulated rainfall deficiency of 6.41 inches for the period from January 1 to April 1. This deficit increased by June 1 to 8.58 inches, and by September 1 to 15.11 inches. The total deficit for the 12 months ending December 31, 1930, was 15.81 inches. September and November were the only months with excess rainfall. Records obtained from four stations in western North Carolina and four in eastern Tennessee, mainly in the mountainous sections, reveal a rainfall deficiency for 1930 ranging from 6.66 to 13.97 inches. Timber losses during 1930 from insect damage were heavy in this area, particularly in the Smoky Mountains.

Temperature conditions during the late fall months also were abnormal and favorable to brood development. Ordinarily there is little insect activity in this region after the first week in October. During 1930, however, the maximum temperature was above 60° F. almost every day during the entire month of October,

and also during the period November 17–24. It is believed that these warm periods hastened the development of the September broods sufficiently to cause their transformation to adult beetles, and that, whereas these broods would normally have overwintered as larvæ and emerged in the spring of 1931, the greater part of them emerged late in the fall of 1930.

Groups of trees over a large area were attacked late that fall. When the broods in these trees were examined on May 7, 1931, it was found that they had not overwintered successfully. Although adults had extended their galleries sufficiently to oviposit and a few tiny larvæ had hatched, all stages (adults, eggs, and larvæ) found during early May were dead. The reason for this has not yet been determined; 7° F. was the lowest temperature that occurred in the vicinity during the winter of 1930–31, and although this temperature was sufficiently low to account for the mortality of the tiny larvæ it is not believed to have been severe enough to affect the eggs. Beal [3] found that eggs of the southern pine beetle, even in the outer bark, survived temperatures of 2° F., at which the other stages succumbed. It is possible that the death of the brood was due to an abnormally moist condition of the inner bark, for the phloem appeared to be unusually wet and soggy, probably owing to lessened transpiration during the winter months.

The activities of the hairy woodpecker are thought to have had a part in the natural control of these broods of the southern pine beetle. It was observed on September 3, 1930, that woodpeckers had already begun to attack the developing broods on one plot of 546 trees. Of these trees 244 had been attacked recently, so that the broods present in them were not yet sufficiently developed to attract woodpeckers. On 120 of the remaining 302 trees the birds stripped off from 20 to 50 per cent of the outer bark in order to reach the maturing larvæ and pupæ, thereby affecting a much larger percentage of the brood than they actually consumed. The warm weather during the late fall brought about a rapid development of the beetles in the 244 trees that had been attacked recently. As the food supply became more plentiful the woodpeckers must have assembled in numbers, because by March 28 they had thoroughly worked over the trunks of all the trees except those in which the adults had matured and mostly emerged.

Spot outbreaks of the beetle were found in other localities and in those places the work of woodpeckers on the stems of infested trees was equally conspicuous, indicating the destruction of a large percentage of the broods.

Subsequent examinations of infested trees in other localities in western North Carolina and eastern Tennessee, particularly in the Smoky Mountains, revealed conditions somewhat similar to those just described.

[3] Beal, J. A.: Weather as a Factor in Southern Pine Beetle Control. Journal of Forestry 25: 742. 1927.

Root Systems of Conifers Growing in Sphagnum

Prompted largely by the observation that windfalls are extremely rare in bogs, although they are common on both glacial till and muck soils in the same region, George B. Rigg and E. S. Harrar, of the University of Washington, made a study of the character and distribution of roots of coniferous trees growing in bogs having a surface layer of sphagnum peat. The field of study was four bogs, Ronald, Esperance, Schrieber Lake, and Evans Creek, all within a few miles of Seattle, Wash. The surface layer of these bogs is from 1 to 3 feet deep and is composed of dead sphagnum that has not disintegrated. In some portions there is living sphagnum at the surface. Immediately below the dead sphagnum there is either a layer of mud one foot or more in thickness or a much thicker layer of sedge peat. Where a layer of mud is present there is usually a layer of sedge peat beneath it. The total depth of organic matter in the bogs varies from 6 to 30 feet. The subjects of the study were the root systems of the six conifers western hemlock (*Tsuga heterophylla*), western white pine (*Pinus monticola*), lodgepole pine (*Pinus contorta*), western red cedar (*Thuja plicata*), Sitka spruce (*Picea sitchensis*), and Douglas fir (*Pseudotsuga taxifolia*). With the exception of Sitka spruce, which in the vicinity of Seattle is found only in bogs and swamps, control studies were made of the root systems of these species growing under normal conditions, mainly on glacial till.

Conclusions from the study were as follows:

The depth of tree root penetration in peat soils is controlled mainly by the height of the water table, though in some cases lack of oxygen, abundance of carbon dioxide, and high acidity may be factors.

The root systems of trees growing in sphagnum are far more spreading than those of the same species growing in firmer soils, and mat-like pedestals often develop.

Excessive root fusion often occurs in sphagnum peat.

Eccentricity of root growth and enlargement is characteristic of tree roots growing in sphagnum peat.

The combined effect of root fusion and elongation coupled with root eccentricity increases the mechanical efficiency of the anchorage of the trees growing in sphagnum peat, and these three phenomena are largely responsible for the lack of windfalls in the bogs of the north Pacific coast.

The eccentricity of root growth revealed in this study is discussed by the investigators as follows:

> Probably the most striking discovery made in this work is the strange shapes of the old roots. In cross section, young roots are circular or nearly so. On the other hand, the older ones are found to be very deep in proportion to their width. Though the eccentricity of growth was on both the top and the bottom of the root, there was much more growth on the bottom than on the top. The transverse sectional

shapes of these roots conform to three general types, namely, the oval, the T-girder, and the I-beam. The I-beam or sometimes nearly rectangular structures were most abundantly found. An examination of tree roots of the same species growing in the firmer glacial till and muck soil depicted a striking contrast with those growing in the sphagnum peat. Although some of the older roots in glacial till and muck approached the rectangular shape near the base of the tree, the more nearly circular form was by far the most common type observed.

The increase in mechanical efficiency with the increase in the vertical axis of the transverse section as compared with the horizontal axis is apparent. It is known that the strength of beams of varying transverse sectional shapes varies approximately with the square of the vertical dimension when the horizontal dimension remains the same.

A rather special case of eccentric growth in roots in sphagnum was observed by the writers in the roots of the western red cedar (*Thuja plicata*). Where these roots have undulated in growth while young, excessive growth has later occurred on the concave side of each curve so that the root is much larger at the curves than in the comparatively straight portions between them. In a characteristic section of one of these thickened regions which was studied in detail, the eccentricity had begun as early as the third year of its life. On the side showing the greater growth, 28 annual rings were counted, constituting a total increment of 2¾ inches, while on the other side the total increment was only ⅜ inch and the rings were so merged that only 20 could be counted.

Eccentricities of growth in stems and roots have long been known. In 1803 Knight arranged apple saplings by a mechanical device so that the wind could sway them only in the arc of a circle, and found that at the end of a year the diameter of the stems in the direction in which they were most exercised by the wind exceeded that in the opposite direction in the proportion of 13 to 11. He also found that when a rigid support was placed around a young tree some distance above the soil so that the wind could sway the trunk above the support, the greatest growth in thickness occurred just above the support. He concluded that the greatest growth takes place where there is the greatest movement.

Ribes Found Growing on Rock Drifts on Shenandoah Forest

Blister rust control agents working on the Shenandoah National Forest, Va., in the spring of 1931 found round-leafed gooseberries (*Grossularia rotundifolia*, syn. *Ribes rotundifolium*) growing not only on bottom lands but on rock drifts well up the slopes, particularly on areas with northern exposure. The rocks were largely bare of vegetation, but were the abode of gooseberry plants in many cases 6 to 9 feet high. Gooseberry roots an inch or more in diameter were found, many of which could not readily be broken off or pulled out. In order to get the root crowns of the large bushes it was necessary to pry loose bowlders weighing sometimes from 50 to 100 pounds.

The areas where gooseberries were found growing on rock drifts are parts of the watersheds of Little River and Briery Branch.

A Classification of Some Wyoming Soil Profiles by Climate and Vegetation

Practically all the mature soils of the Big Horn Basin, in northern Wyoming, are fundamentally the same from a scientific standpoint, but as one ascends the surrounding foothills and mountains striking differences in soils and in vegetation may readily be observed, writes James Thorp, of the United States Bureau of Chemistry and Soils, who during the summers of 1927–1929 worked on soil surveys of the agricultural lands of the Big Horn Basin. Mr. Thorp's observations, and tests of soil samples, point to the following conclusions regarding the effects of vegetation and climate upon soil profiles in northern and northwestern Wyoming:

The presence or absence of lime in the soil, as determinable by ordinary field observations, depends upon the humidity of the soil as determined by the rainfall combined with the average annual temperature. Where the rainfall is light, lime forms in the soil more rapidly than it can be leached out by percolating waters, and it accumulates in a horizon which lies at the depth of average moisture penetration. As the rainfall increases, the depth to this horizon of lime accumulation increases until under a rainfall of approximately 20 inches it disappears altogether so far as can be determined by simple tests with acid.

Gypsum and salt accumulations disappear sooner than the lime under the conditions mentioned in the foregoing.

The thickness of the heavy subsoil or upper B horizon increases with the increase in rainfall, other things being equal. This is the horizon of maximum illuviation.

The color of the soil is determined largely by the proportion of grasses in the vegetation; the more grass, the darker the soil. Of course the quantity of grass is largely dependent upon the rainfall in turn.

Under like conditions of rainfall and parent material a forest vegetation causes the formation of an altogether different soil from that formed under a prairie vegetation.

Topsoils in this region have a pH value of 6.5 or more when the precipitation is less than 20 inches, and less than 7 when it is 20 inches or more. The pH values are lower in forested soils than in prairie soils under the same rainfall conditions. In the pedocals (soils having horizons of lime accumulation) the pH is highest in the horizon of maximum lime accumulation, whereas in the acid prairie and forest soil it is highest in the C horizon.

On the basis of profile differences Mr. Thorp has grouped the soils of northern and northwestern Wyoming into six classes. Soils are pale gray-brown on the desert and become progressively darker as altitude and rainfall increase with the exception of group 6, which is associated with heavy conifer forests. The first four groups belong to the pedocals and are separated from one another chiefly on the basis of the darkness of the color of the A horizons. Groups 5 and 6 are both in humid zones. Although parent materials are frequently the same under both these groups, the profiles differ greatly owing to a great difference in vegetative cover. Whereas group 6 has a heavy growth of conifers, group

5 has a heavy sod of grasses and flowers with no trees. Precipitation, vegetation, and topsoil color in the six groups defined are indicated in the following table:

Soil group	Topsoil color	Precipitation	Vegetation
		Inches	
1	Pale gray-brown	5–10	Salt sage, sagebrush, rabbit brush, needle grass, grama grass, fleabane, pentstemon, pricklypear, paintbrush, shadscale.
2	Light brown	10–15	Sagebrush, salt sage, grama and other grasses, lupine, larkspur, paintbrush, pentstemon, Mariposa lily, wild buckwheat, some juniper, loco, and gaillardia.
3	Chestnut brown	15–18	Same as above with no salt sage and with more sagebrush and a heavier sod.
4	Nearly black	18–20	More grasses and sagebrush than above.
5	Black or brown	20–40	Little sagebrush; heavy sod of grasses, lupine, pentstemon, paintbrush, gaillardia, harebell, forget-me-not, shootingstar, etc.
6	Ashy gray	20–40	Lodgepole pine, Douglas fir, Engelmann spruce, ground juniper, lupine, paint brush, harebell, gentian (moist spots), and others.

Erosion Research Station for Lake States

Studies of soil erosion under upper Mississippi Valley conditions and of methods for its control are to be conducted on a farm of 160 acres 4 miles east of La Crosse, Wis., by the Lake States Forest Experiment Station and the Wisconsin Agricultural Experiment Station, with cooperation from the Bureau of Chemistry and Soils and the Bureau of Agricultural Engineering. The State of Wisconsin is furnishing the farm (funds for the purchase of the farm were provided by the State emergency board), and the United States Department of Agriculture is providing the funds for operating the farm and conducting the research.

The farm selected is located at the top of a high ridge overlooking the city of La Crosse. About half of it is cultivated and about half is in woodland pasture. The topography is such that all the water running off the farm can be measured in five gullies which drain the area, and that it is possible to lay out experimental plots having many degrees of slope from virtually level to very steep.

At least two of the gullies draining the farm are actively cutting back into the soil. The emphasis of the research will, however, be on means of preventing erosion rather than on means of curing it. Engineering structures such as soil terraces, and soil-management methods such as strip planting, will be tried out under conditions that will permit accurate measurement of their effectiveness in preventing erosion. Because dairying is the chief agricultural enterprise of the region, it is planned to maintain a dairy herd on the farm. The herd will serve a purpose in connection with the development of satisfactory methods of using the steeper slopes for pasture. The roughest land will, of course, be devoted to timber growing.

This fall a detailed topographical map of the farm is being made. Early next spring the engineering devices for erosion control and measurement will be installed and experimental plots will be laid out.

The southeastern portion of Minnesota and the southwestern and western portions of Wisconsin, particularly in the unglaciated region, are characterized by a rugged topography and by a soil especially susceptible to destructive gully erosion. Sheet erosion, also, is a serious problem on these areas and is causing considerable damage in other parts of Wisconsin. Erosion control represents one of the most urgent economic problems confronting farmers of this section.

Tree Planting at the Pennsylvania Masonic Homes

By E. F. Brouse, Pennsylvania Department of Forests and Waters

Among the most interesting tree plantings in Pennsylvania are those of the Masonic homes, located at Elizabethtown, which is about midway between Lancaster and Harrisburg. Here a property of 1,000 contiguous acres was purchased in 1910, upon which suitable buildings have been erected from time to time to house "dependent Free Masons in this jurisdiction, and the dependent wife, widow, mother, or minor children of such Free Mason." From the beginning an unusual interest was manifested in planting trees and landscaping the grounds. Expert advice was obtained and careful plans were made for the purpose of "improvement and decoration of the grounds." Late in 1910 the committee reported that "a system of forestation has been instituted so as to assure a uniform and harmonious development of the property into a State arboretum, by which the grand lodge will have therein a clump or grove of every kind of tree or shrub that is indigenous to the Commonwealth." The 1911 committee reported that "a complete planting plan for trees and shrubbery has been prepared."

By the end of 1912 a total of 56,300 trees and shrubs had been planted. The planting has been continued through all the succeeding years, and there have now been set out more than 100,000 plants which at a conservative estimate are today worth several hundred thousand dollars. There are now approximately 360 different species and varieties of woody plants on the grounds, representing almost all sections of the United States and a number of foreign countries including Japan, China, Africa, and Korea. Central Europe is especially well represented.

The grounds proper, aside from the tillable land, are a huge garden of trees. However, they do not appear overplanted; in fact, there are places for many additional trees. S. V. Reese, the landscape architect in charge, who has been at the homes since the start, states that originally the plantings included specimens of all the trees native to Pennsylvania. The represent-

atives of some few species failed to grow, and those of a few others were destroyed through the erection of new buildings and through road construction. The number of different kinds is constantly being increased, although no special effort is being made at present to grow all the trees native to Pennsylvania.

Probably the most outstanding of the many interesting groups of trees planted about the grounds are several memorial groves. In 1918, 112 northern white pine trees were planted as a memorial to the past masters of the grand lodge of Pennsylvania, and since that time several have been added to this number. The trees were planted about 20 feet apart and are now 15 to 18 feet in height. An oak grove planted in memory of the Pennsylvania Masons who lost their lives in the World War consists of 268 oaks of eight different species, all native to Pennsylvania. These trees, from 15 to 30 feet in height, cover a small knoll about one-quarter mile from the main group of buildings. A beech grove consisting of 57 trees of nine species and a white birch group with 27 trees 25 to 30 feet in height present a striking appearance. Native dogwood has been intermixed with introduced species of varied color, with the result that striking effects are produced in the flowering season. What is probably the most pretentious group, planted about Grand Lodge Hall, contains more than 2,100 woody plants of 102 different kinds.

For the most part the plantings are informal. Most of the trees are now 15 to 20 years old and are of such size that individually, as well as in groups, they are truly beautiful.

Tree planting has not been confined to the campus. Trees were set out on unproductive areas about the farms, and a portion of the woodland was restocked. Approximately 90,000 seedlings and transplants of 26 species have been planted for timber purposes. Of this number about 80 per cent were northern white pine, Norway pine, and Norway spruce. Some of the white pine and Norway spruce planted in 1910 now are 30 to 35 feet in height and are making excellent growth. Norway pines set out in 1918 average from 12 to 15 feet in height and most of the other species are growing reasonably well. In earlier years the white pine was attacked by the weevil, and some little difficulty has been experienced with several other insects. The trees have been comparatively free from disease. The plantations have suffered somewhat by the removal of trees to be planted singly or in smaller groups about the grounds for ornamental purposes.

A prostrate juniper growing naturally near the grounds is estimated to be more than 160 years old. It has a spread of 45 feet and averages only 3 feet in height. A large number of cuttings have been taken from this tree and planted at the homes, with the result that more than 100 thrifty specimens from 2 to 8 feet in spread are growing about the grounds. The largest has a spread of 15 feet and is approximately 2½ to 3 feet in height.

The landscape department of the homes operates a tree and shrub nursery covering an area of about 5 acres. According to a recent inventory, the nursery contains 80,000 plants of 230 varieties, from 3 inches to 8 feet in height. Surplus nursery material is often available and is sold at a low price, usually to members of the fraternity. The receipts range from $200 to $5,000 a year. In 1930 they amounted to $2,647. This revenue, in addition to a yearly sum of approximately $640 made available through an endowment, portends the perpetuation of the plantings.

International Association of Wood Anatomists Adopts Constitution

The constitution of the International Association of Wood Anatomists was adopted at Paris in July, 1931, during the Congrès International du Bois et de la Sylviculture, at a meeting attended by 25 persons representing Belgium, France, Germany, Great Britain, Holland, the Philippine Islands, and Spain. Pending the election of a council executive powers were placed in the hands of the organizing committee, of which Samuel J. Record, professor of forest products in Yale University, is secretary. Persons actively engaged in the study of wood anatomy are admissible as ordinary members, and provision is made for admitting as corporate members institutions or other corporate bodies interested in wood anatomy.

The object of the association is "to advance the knowledge of wood anatomy in all its aspects." Activities which the body undertakes are "to interchange ideas and information through correspondence and meetings; to facilitate the collection and exchange of material; to work toward standard terminology and descriptions; to stimulate the publication of scientific articles and abstracts; and to encourage and assist the study and teaching of wood anatomy." Persons interested in the activities of the association are invited to correspond with Professor Record.

Correction: The recent decision of the Federal Trade Commission, reported on page 18 of the September, 1931, Forest Worker, permitting the use of the term "Philippine mahogany" as a trade name for the woods which have commonly been known by this name, specifies that the term "mahogany" must not be employed in the sale of these woods without the modifying term "Philippine."

Visitors to the national parks in the year ending September 30, 1931, numbered 3,152,845, or 14 per cent more than in any previous year. Yosemite Park alone had 461,855 visitors.

Foreign Notes

Squirrel Damage to Forests in Great Britain

(Abstracted from article by A. D. MIDDLETON, University Museum, Oxford, in the Quarterly Journal of Forestry, October, 1931)

The spread of the American gray squirrel in Great Britain in recent years has been noted by British foresters with consternation. Before the end of the last century the British forester had only one species of squirrel to contend with in his efforts to raise straight and sound timber. That species, the red squirrel, has suffered a great reduction in numbers during the past few years, mainly as a result of disease, so that in most parts of the country its depredations have become almost negligible; but every estate in the north of Scotland where large areas are occupied by pure stands of Scotch pine has suffered enormous losses from peeling by squirrels since the beginning of the present century. On the Novar estates in Ross-shire, Viscount Novar estimates that in 1900 the damage to Scotch pine plantations by squirrels amounted to £10,000 and that the value of the Scotch pine timber now standing is reduced by £10 per acre owing to the peeling carried on when the trees were young. Squirrel damage to Scotch pine is by no means unknown in England, and the creation of large planted forests of conifers throughout the country is likely to produce local conditions very similar to those of north Scotland. The factor most affecting the extent of the damage is undoubtedly the nonavailability of other foods for the squirrels in early summer.

From mid May until the end of July, when the sap is actively moving, the red squirrels peel the bark from the young Scotch pines and eat the succulent inner bark or cambium layers. This peeling is generally limited to wood of from 4 to 8 years' growth, on trees 12 to 25 years of age, and the main stem is usually the part most attacked. On the average Scotch pine of 15 to 20 years the point of attack is generally between 4 and 8 feet from the top. The main stem is either completely girdled or peeled in patches of various sizes. Where the squirrel peels at all he peels an area of several square inches, and in many cases a length of 2 or 3 feet on the main stem is practically stripped of every vestige of bark.

When a tree is completely girdled the top either dies and decays or is broken off by the wind. This often results in the death of the whole tree; in most cases, however, a lateral from a point below the peeled area takes the lead or two or three laterals make equal growth, with the result that the tree can never form a straight bole of any timber value. When the cambium is stripped from considerable areas but not so that the trunk is girdled, the tree may be able to continue growth, though often in a weakened condition. Callus is formed around the edges of the wounds, but it is impossible for new wood to form and the proper increase in girth to take place on the peeled area. In the course of years the outward growth of the sound cambium around the edge of the wound causes the callus to close over the depression and the expansion of the surrounding areas completely covers it, the bark sometimes becoming whole and continuing growth. When the timber is cut, probably 80 or 100 years after the peeling, the tree may outwardly appear to be sound but because of a deep-seated fissure edged with callus at the site of the damage many of the largest planks sawn from the bole are faulty. The growth of fungus spores also is facilitated by patch peeling. Indiscriminate ringing and peeling by a large squirrel population often damages more than half the trees in a plantation; consequently it is almost impossible to obtain a full stand of sound mature pines where squirrels are very numerous.

The British red squirrel (*Sciurus leucorous*) is primarily a resident of coniferous forests, and its feeding habits appear to be especially adapted to the conditions of a pine forest. Scotch pine is the only species grown in Great Britain that is especially subject to peeling by red squirrels; in a few localities, however, notably in the south of England, both European and Japanese larch have been similarly peeled when squirrels were very numerous. Because there is no British squirrel especially adapted to life in hardwoods the red squirrel has to a certain extent modified its feeding habits (especially in England) to occupy both coniferous and deciduous woodlands.

The gray squirrel (*Sciurus carolinensis*) has a much wider food range than the red, being especially prone to eat fruit and garden produce. In destroying buds and shoots of trees and in eating seed it differs little from the red, and it likewise carries out extensive peeling on young trees and the young wood of older trees; but all the records of its depredations of this sort refer to hardwoods, never conifers. The species most subject to peeling by gray squirrels is sycamore, with beech as a good second. Young trees of these species have been damaged extensively by the gray squirrel in many parts of Great Britain. The method is very similar to that of the red squirrel, the bark and cambium being peeled from large patches often with the result that the tree is girdled. The worst peeling is on 4 to 10 year old wood, and generally on trees of 10 to 20 years' standing, although in some cases the gray squirrel has been observed to peel the bark from branches of mature beeches. Other hardwoods peeled

in the same way are oak, ash, maple, walnut, horse chestnut, birch, and lime.

Squirrels have no predatory enemies of any significance in Great Britain, and methods for biological control or poisoning of squirrels have not been completely investigated. Shooting is the favored control method, with trapping as an alternative.

The Beech Woods of the Balkan Peninsula [4]

By N. Stoyanoff, Institute of Agricultural Botany, Sofia

Beech woods are widely spread in the mountains of the whole Balkan Peninsula, with the exception of the southernmost parts. The southern limit of the genus Fagus is on Mount Oxya in Greece. The woods are most characteristically developed in the central districts of the peninsula and the largest is that covering the slopes of the Balkan range for a length of about 250 kilometers.

Two species occur, *Fagus silvatica* L. and *F. orientalis* Lipsky, and each requires a certain degree of humidity of the air. The former is consequently found in the damp altitudinal zone of the mountains, and the latter, which requires a higher temperature, in damp valleys at lower altitudes. Under more humid climatic conditions, as for example on Mount Strandza in eastern Bulgaria, *Fagus orientalis* also occurs in open places.

In the northwestern parts of the Balkan Peninsula *F. silvatica* shows practically no altitudinal lower limits, and this is true also of *F. orientalis* in the east. Over the greater part of the peninsula, however, the common beech has a definite lower limit of distribution varying from 300 meters to 1,100 meters, being higher in the south than in the north and on southern slopes of mountains than on northern.

The natural upper limit lies between 1,700 meters and 2,000 meters. It is, however, often lowered in consequence of unfavorable ecological conditions or of an intense development of coniferous woods.

Beech woods usually prefer the northern slopes to the southern, and this preference is more marked towards the southern limit of distribution.

The beech is generally indifferent to the chemical nature of the soil, though in Istria and Albania it shows some preference for calcareous soils and in the continental eastern regions, as in Bulgaria and east Macedonia, it evidently prefers siliceous soils. The edaphic conditions are thus complementary to the climatic. In all parts of the peninsula the beech avoids very moist soils. Well developed woods are usually to be observed on slopes not steeper than 50°.

Beech trees are taller in the west than in the east of Bulgaria. Thus the mean height of the oldest beech trees growing on the western parts of the Balkan chain is 37 meters, on its central part 34 meters, and on its eastern part 23 meters. On the Rila Mountains and also in eastern Serbia beech trees are recorded which are 40 meters or more in height.

Fagus silvatica usually shows a considerable power of rejuvenation both by seeds and by shoots. *F. orientalis*, on the contrary, regenerates but slowly and shows a tendency to be replaced by oaks.

About 40 species of trees and shrubs occur in the Bulgarian and Illyrian beech woods. At the upper part of the beech belt the beech woods usually merge into coniferous communities. A narrow zone of mixed forest, with *Betula alba* predominating, may sometimes be observed between the beech belt and that of the conifers. At their lower altitudinal limits the beech woods merge into oak woods, mixed broad-leaved woods, woods of Castanea, or woods of *Pinus nigra*.

More than 300 herbaceous species are considered typical for the Bulgarian beech woods and about 300 are quoted by Beck for the beech woods of the Illyrian countries.

The composition of the Bulgarian beech woods shows a considerable resemblance to that of woods growing in countries so far distant as Sweden and England. This resemblance can be explained by the common history of the constituent elements. From this standpoint the beech wood can be regarded as a vegetational unit, in which most of the characteristic species have had an ancient origin and a similar distributional history.

The beech belt in the Bulgarian mountains and probably also in those of Macedonia shows a tendency to extend upwards, thus replacing coniferous woods. It is possible that the post-Diluvial (post-Glacial) changes in the vegetation are not yet completed in these countries.

The beech forests of the peninsula are relatively less destroyed by the activities of man than other kinds of woods such as those of oaks and conifers.

Fagus silvatica and *F. orientalis* when growing together in eastern Bulgaria are connected taxonomically by intermediate forms. These are observed in all localities where the species meet. In the eastern part of the Balkan chain whole forests are formed by such intermediate types.

[4] Paper read at the Fifth International Botanical Congress, Cambridge, England, August, 1930.

Spruce too Small for Pulpwood Makes Fenders for Welland Canal

Long, straight, slender poles of black spruce about 4 or 5 inches in diameter at the butt and between 30 and 40 feet in length, neatly cut and peeled, are being used to make fenders for the Welland Canal. This new use for spruce below pulpwood size is discussed by E. Newton-White in the Illustrated Canadian Forest and Outdoors as follows:

These poles were cut from trees that many of us have cut down by the acre and the hundred thousand in land-clearing work. Trees that in the bush we have cut only for skids, or perhaps to make the pole roof of a cabin.

* * * A fender "pole" is composite. * * * A form is built into which the little long poles are

packed to form a long cable or boom, 3½ feet in diameter.

Three to four hundred feet long are these fender poles. The individual pieces which go to their making are carefully placed for a snug fit, and well spiked together. Three or four steel cables are incorporated longitudinally as reinforcement. At intervals the "pole" is bound by cables round its girth. And to the making of one fender pole goes some 2,300 pounds of cable and 27 kegs of spikes.

At certain places on the canal the fenders are placed to float attached to a row of deep-driven piles. Placed at the feet of the towers of the railway and highway bridges which cross the canal in its 25-mile length, their purpose is shock absorbing. The avoidance of jars to a tall structure which, as in the case of a "vertical lift" bridge, is designed to hoist up a 200-foot span a clear 120 feet above the water level, must be of no small importance. These fender poles, from the material and nature of their construction, have "give," as well as great strength. The piles to which they are attached have "give" also. Placed out a little distance from the vital spots to be protected, the combination takes up the force of a glancing contact with the momentum of a big ship.

But to return to our little black spruce trees. The men who cut and peeled them were quite pleased with the work, its unfamiliarity notwithstanding. * * * Drawknifing is, perhaps, something of a refinement in bush work. The pay was by the foot, with a bonus given on certain conditions. In reasonable weather, when the bark and sapwood was not too hard frozen, and there was a fair bush to work in, a man could cut and shave 15 or 20 poles in a day. He cut down his selected trees, trimmed them up neatly, and pulled, carried, or slid them out to where he had some improvised arrangement which held them up in good position for manipulation of the drawknife.

Some idea of the nature of this black spruce can be gathered from the specifications of the contract. The poles had to average 35 feet, with nothing below 30 feet accepted. The maximum butt diameter had to be 5 inches and the minimum 3¼ inches. The tops measured at 1 inch. * * *

As a matter of fact, some of the individual poles cut for this purpose showed a length of full 40 feet, yet with less than a 4-inch butt, and were straight as gun barrels at that. Straightness was a prime requirement.

* * * Handled without care in the severe frost—20° and 30° below zero—when green timber may be expected to be as brittle as china, these lissom rods refused to break. The teamsters loading them onto the sleighs in the bush disentangled them from the piles, where their ends ran down under deep snow and rubbish, with heaves that bent them like whips; but they did not crack. The men threw them onto the loads, or onto the pile at the siding, or onto the flat car at the loading, with handling that would have jarred a frozen hardwood pole into fragments; but it did not hurt these.

* * * Those trees, for all their slimness and general appearance of youth, are just as old as the bigger trees among which they grow. Well over 100 years in many instances. They are the trees of the forest stand which, in the early competitive struggle among themselves for existence, managed to attain a place in the sunlight, but no more. They were never overtopped, but surrounding trees managed to grab up the best soil space and so these grew lean from meager nourishment. But they grew tough, as lean people often are.

And yet, in spite of their qualities and the time which has gone to the making of this unique timber * * * they have always been a waste product of the northern bush. These trees are left standing after the closest pulpwood operation that was ever conducted, because even their butts barely come within pulpwood specifications. As firewood they have no appeal because of the small size.

Left standing after timbering operations, these trees do not survive one in a hundred. With the protection of their fellows removed they speedily wilt to the pitiless light beating in on them from tip to root. The storms lash them about and they uproot; or the snow and ice settles on them with an insupportable load, and they take a permanent bend. They lose vitality, whereupon insects and fungi get in their work. More likely than anything the slash fire gets them.

So here is a sometime despised and neglected material which is yet capable, at the inventive command of some engineer, to serve a humble but very useful part in the operation of the great Canadian ship canal.

Personals

Samuel Newton Spring, professor of silviculture at Cornell University, has accepted appointment as assistant dean of the New York State College of Forestry, at Syracuse University. This position, newly created, carries responsibility for coordinating education and research at the college and for directing instruction both at the college and at the New York State Ranger School. Professor Spring will assume his new duties early in 1932. Before joining the Cornell forestry faculty in 1912 Professor Spring, who is an alumnus of the Yale School of Forestry, had experience in the United States Forest Service and as State forester of Connecticut.

Lorne W. Barclay, formerly with the Oregon Trail Memorial Association, has been appointed to the newly created position of director of the National Parks Association.

M. W. Talbot, who has had charge of weed investigations in the Division of Botany, Bureau of Plant Industry, since 1923, and who before that was engaged in range research in the Southwest as a member of the United States Forest Service, has been transferred to the California Forest Experiment Station, where he will have charge of range management studies. Mr. Talbot is the author of a number of publications on range management.

W. R. Stevens has been placed in charge of the forest fire weather work of the United States Weather Bureau, with headquarters in Washington, D. C. The bureau now has forest fire weather work in progress in California, Washington, Oregon, Idaho, the Lake States, and the Northeast. Heretofore Mr. Stevens assisted in the forecast division of the Washington, D. C., office of the bureau.

Members of the Minnesota Conservation Commission recently appointed by the governor under provisions of a new law reorganizing the commission are William E. McEwen, Duluth; James T. Williams, Minneapolis; John R. Foley (secretary), Wabasha; Richard R. Bailey, Virginia; and Ernest T. Reiff, North St. Paul.

T. J. Starker, professor of forestry in the Oregon State Agricultural College, is spending his sabbatic year at the Pennsylvania State College as visiting professor of silviculture. He is substituting for H. J. Lutz, who is enrolled in the Yale School of Forestry as a candidate for the doctor's degree.

Guy R. Stewart has been appointed senior forest ecologist at the Northeastern Forest Experiment Station, in charge of planting studies. Doctor Stewart was formerly in charge of plant nutrition work in the University of California, and has had experience in that field in Hawaii. He received the Ph. D. degree this year from Cornell University.

Dwight B. Demeritt, who has been connected with the forestry department of the Pennsylvania State College for the past few years, is now associate professor of forestry at the Iowa State College. He succeeds D. S. Jeffers and has charge of the work in mensuration, management, administration, and protection. Professor Demeritt holds forestry degrees conferred by the University of Maine and Yale University. In addition to experience in teaching at the University of Maine and the Pennsylvania State College he has had two years' experience in forestry extension in Louisiana.

B. A. Krukoff, a graduate of the New York State College of Forestry, who within the past few years has done field work in forestry in tropical Africa, Brazil, and Sumatra, has recently returned to Brazil for several months' field work. In connection with certain commercial investigations which he has been authorized to make, he plans to prepare a comprehensive series of botanical specimens in cooperation with the New York Botanical Garden. This material will be studied and identified by members of the staff of the New York Botanical Garden in cooperation with specialists in the United States and in Europe. Extensive series of duplicates that Mr. Krukoff plans to prepare will later be distributed by him to institutions interested in obtaining such material.

Allen W. Goodspeed, for the past two years forester for the Litchfield Forestry Association, Litchfield County, Conn., has been made instructor in applied forestry in the Yale School of Forestry, from which he was graduated with the M. F. degree in 1929. Mr. Goodspeed received the B. S. degree in forestry from the University of Maine in 1928. He will work with Professor Hawley, devoting most of his time to the operations on the Eli Whitney Forest.

F. G. Renner has been transferred from the Intermountain Forest and Range Experiment Station, Ogden, Utah, to the California Forest Experiment Station, at Berkeley, Calif., where he will take part in range investigations. G. W. Craddock, of the intermountain station, has been assigned to the Boise erosion project as Mr. Renner's successor.

J. D. Sinclair, who has had charge of erosion studies of the Southern Forest Experiment Station, is being transferred to the California Forest Experiment Station to work on erosion studies directed by W. C. Lowdermilk.

S. B. Locke, who has had charge of forest and range biological investigations of the Intermountain Forest and Range Experiment Station, has resigned to accept a position with the Izaak Walton League.

S. V. Fullaway, jr., formerly secretary-manager of the Western Pine Manufacturers Association, is now secretary of the newly formed Western Pine Association, of which David T. Mason is manager. Mr. Fullaway resigned from the United States Forest Service in 1927 as chief of the branch of forest products in the Missoula, Mont., regional office.

Robert A. Zeller, since 1922 supervisor of the Tongass National Forest, Alaska, has been transferred to the supervisorship of the Superior National Forest, Minn. Mr. Zeller is a native of Pennsylvania and a graduate of the Pennsylvania State Forest School. When he entered the Forest Service in 1917 his first assignment was as a ranger on the Superior Forest.

Charles Whitfield has been appointed associate forest ecologist at the Southwestern Forest and Range Experiment Station, Tucson, Ariz. Mr. Whitfield has for a number of years assisted F. E. Clements, of the Carnegie Institution, in his ecological work at Santa Barbara, Calif., and is working for a doctor's degree from the University of Chicago. In his new position he will assist C. K. Cooperrider in range management research.

Aubrey H. MacAndrews, of the department of forest entomology, New York State College of Forestry, has been promoted to an assistant professorship and is now in charge of the department.

J. Lee Deen, who received the M. F. and Ph. D. degrees from Yale University in 1929 and 1931, respectively, is now an instructor in silviculture in the Yale School of Forestry. Mr. Deen received the B. S. degree in forestry from the University of Minnesota in 1927.

K. S. Trowbridge is now county forester for Liberty and McIntosh Counties, in south Georgia, a territory including much forest land naturally well adapted to slash pine. His headquarters are at Darien. Mr. Trowbridge was formerly one of two State extension foresters in Georgia.

Bibliography

Woody Plants of the Northern Rockies

By W. A. Dayton, United States Forest Service

Tree books are fairly common but a treatise covering both trees and shrubs is, indeed, a "rara avis in terris, nigroque simillima cygno." Such a rarity is the posthumous book[5] of the late Joseph Edward Kirkwood, whose untimely and lamentable passing in August, 1928, was a shock to his numerous friends and to others familiar with his work or interested in the flora of the Western States. This octavo volume, with good paper and excellent typography (the Latin names in boldface), handsomely bound in green buckram, consists of 340 printed pages, 35 photographic plates, and 87 text figures, most of which are from Professor Kirkwood's own versatile pen.

This very useful and attractive book begins with a biographical sketch of the author by Morton J. Elrod, professor of biology in the University of Montana, followed by the author's preface. An introductory chapter of 11 pages deals with such features as the philosophy of botanical studies, the topography, climate, and geological history of the region as correlated with its flora, and the relations of its flora to those of contiguous regions, and includes also a statistical summary, by families, of the plants discussed. The body of the book consists of notes, by families, genera, and species, with keys to genera and species. The treatment covers 27 families, 79 genera, and 248 species. While chief emphasis is placed on the systematic and distributional phases, considerable attention is paid to such subjects as history of the species, phenology, pollination, reproduction, associates, and tolerance. Economic notes, while not so general or full as might perhaps be desired, are not wanting, especially in the family and generic descriptions. The publication concludes with a 12-page illustrated appendix on botanical terminology and separate indices of common and scientific names.

The nomenclature follows the American Code. It is reasonably conservative, and, with few exceptions, consistent. There may perhaps be a justifiable question, for example, as to whether the acceptance of Atragene and Bossekia as valid genera is consistent with the suppression of Azaleastrum, Dasiphora, and Leptodactylon; but, of course, these are matters on which it is impossible to obtain universal agreement. It is regrettable that the author uses Holodiscus instead of the much older Sericotheca. The *Odostemon aquifolium* discussed on page 127 appears to be *O. repens*. On page 165 the author states that Bossekia differs from Rubus "in having simple leaves, smooth stems, and a few other marks." This is somewhat confusing because such simple-leaved, nonprickly-stemmed species as *R. chamæmorus* and *R. odoratus*, from Linnaeus down, have been universally defined as of the genus Rubus.

A valuable and useful feature of this publication is the accentuation of scientific plant names, which, in general, seems to have been accurately done. Pentstemon, however, should be accentuated on the penult rather than on the first syllable, the second "e" being long. The author uses the acute accent for short vowels and the grave accent for long or broad vowels. There is a little inconsistency in the use of these accents; for example, the acute accent is used on the "i" of the trivial name in *Symphoricarpos oreophilus*, whereas the grave accent is similarly used in *Vaccinium oreophilum*.

In the Rhamnus key (p. 224) *R. alnifolia* and *R. purshiana* are separated solely on the basis of the former being a "low shrub" and the latter a "small tree," which seems unfortunate in view of the radical differences between the two species in inflorescence, leaf venation, etc., and in view of the inevitable occurrences of luxuriant alnifolia and depauperate purshiana. In the key to Ericaceæ (p. 248) the genus Rhododendron is confined to the group with evergreen leaves; yet in the description of the genus (p. 257) the leaves are described as "evergreen or deciduous," and *R. albiflorum* (pp. 258–259), which the author regards as a true rhododendron, has, of course, deciduous leaves.

To those who, like myself, are interested in and value vernacular names the free use by Doctor Kirkwood of English plant names is most pleasing. Writers in the United States Department of Agriculture are subject to restrictions in having their English plant names harmonious and consistent, since they can not follow Standardized Plant Names rules in names, not already in that work, that appear in diverse form in the Style Manual of the Government Printing Office or in Webster's Dictionary. Free as he presumably was of such restrictions, it seems regrettable that Doctor Kirkwood did not write his English plant names in altogether consistent fashion, preferably in accordance with the simple, reasonable, and logical rules of Standardized Plant Names. For example, it is logical and in better form to write mockorange and pricklypear solid and to hyphenate hop-sage, mountain-ash, and Oregon-grape rather than to write such names as two words, since those plants are not true oranges, pears, sages, ashes, and grapes, respectively. Moreover such names as buffaloberry and twinflower are preferably written solid rather than as two words, since they connote a unified idea (generic concept), just as a Latin generic name is never written other than as one word (though occasionally hyphenated). In writing English plant names the hyphen, of course, should be used only as a last resort, and the apostrophe probably

[5] Kirkwood, J. E.: Northern Rocky Mountain Trees and Shrubs. 340 pp. Stanford University, 1930.

can always be eliminated. The plant names feltleaf, heartleaf, and greenback willow and redberry elder are preferable to the forms felt-leaved, heart-leaved, greenbacked, and red-berried. "Wood's rose" (which is obviously incorrect) should become Woods rose, "Fendler's rose" is better rendered Fendler rose, and so on. "Sessile-leaved willow," for Salix sessilifolia, is entirely too bookish a name ever to find general acceptance; personally I prefer such a name as velvet willow.

A sidelight on Doctor Kirkwood as a man and a botanist, which needs no comment, is seen in the absence of his name as authority for any plant mentioned in this volume.

Plant lovers, botanists, and foresters are sadly susceptible, as a class, to the argumentum ad crumenam; the usefulness of this volume is, therefore, handicapped by its cost, $7.50.

Dengler's Waldbau

By C. F. Evans, United States Forest Service

In his 594-page volume Waldbau auf Oekologischer Grundlage [6] (Silviculture on an Ecological Basis) Alfred Dengler, professor of forestry in the Eberswalde Forest School, devotes 266 pages to the subject of forest ecology before he takes up the subject of silviculture. He states the reason for this in the foreword as follows: "Only a complete mastery of the ecological bases makes possible a correct understanding of the complicated relationships in the life of the forest and therewith also a scientific foundation for all silvicultural measures." The average American reader will probably wish that even more space had been reserved for ecology at the expense of silviculture. The principles of ecology are universal in their application, while the technique of silviculture must be localized. Dengler says "All silviculture is local, indeed often conditioned by the smallest area. But these variations are by no means without order. They all can be traced back finally to the same universal and orderly relationships that exist between the exceedingly varying site on the one hand and the species and management on the other."

An outstanding characteristic of the book, and one that adds greatly to its value to the student, is the manner in which the author manages to present a balanced treatment of disputed questions, drawing freely from the work of others and stating his own views with modest brevity. To assist the reader in further study a most comprehensive bibliography is provided.

The following condensed outline will give a general idea of the contents of the book:

Part I. *Ecology of the forest as a basis of silviculture.*—

Section 1: The forest as a type of vegetation. Eight chapters of description of forest zones of the world. History of the changes in forest composition in Germany.

Section 2: The influence of life factors on the individual species. Seven chapters covering the following factors: (*a*) Heat, (*b*) water, (*c*) light, (*d*) carbonic acid, (*e*) wind, (*f*) soil, and (*g*) inherited tendencies.

Section 3: The life processes and the course of life in the forest. Six chapters as follows: (*a*) Blooming and fruiting, (*b*) reproduction and distribution, (*c*) germination, taking root, and establishment, (*d*) further development in early youth, (*e*) development in the pole and tree ages, and (*f*) age, sickness, and death.

Part II. *The technique of silviculture.*—

Section 1: The kinds or types of stands. Six chapters of description of the different forest types in Germany, with a detailed discussion of the use of exotic species.

Section 2: The establishment or reproduction of stands. Nine chapters dealing with reforestation and afforestation, both by natural and by artificial means.

Section 3: Culture and care of the stand. Two chapters on release cuttings, thinnings, pruning, cultivating, and other measures.

Section 4: The economic or management forms of the forest. Three chapters on silvicultural treatment or cutting methods.

Of special interest and value to American foresters is the very full treatment of the following subjects:

1. The interrelationships of forest and soil and the effect on the soil of such practices as clear cutting, removal of litter, grazing, etc.

2. The use of exotics. German experience with exotic species has not been altogether happy. In many cases exotics that showed early promise have later failed to do well. Exotic species and even species indigenous to Germany are found to have climatic varieties. It is to be hoped that American foresters will profit by German experience and not try to establish species in regions that are climatically unfavorable to them. This matter calls for consideration in the case of northern white pine and Norway pine, for example. At present many planters in the eastern United States are using seed of these species without giving proper attention to its source.

3. Adaptation of species to environment and the effects of radical changes in environmental factors, e. g., sun scald produced by sudden release.

This book probably contains comparatively little that is new or that represents original work by the author. It is rather to be regarded as a comprehensive compilation of existing information. The American student of forestry will find it well worth reading.

[6] Julius Springer Press, Berlin.

A paper by Donald Bruce and L. H. Reineke, on Preparation of Volume Tables by an Alinement Chart Method, has been mimeographed by the United States Forest Service, in order that the information it contains may be made available to those interested earlier than the paper can be gotten out in printed form. Requests for copies should be addressed to the United States Forest Service, Washington, D. C.

Seeding and Planting

By E. E. Carter, United States Forest Service

Clarence F. Korstian has made a needed revision of Professor Toumey's 15-year-old textbook, Seeding and Planting in the Practice of Forestry.[7] The result should be to restore the book to at least its former eminence in the classroom and in the reference library. Doctor Korstian, in his preface, takes the responsibility for the changes.

Probably the strongest impression the volume gives is that of care taken to search the literature on the subject. Occasionally there is a statement of some experiment made or practice developed by Professor Toumey himself, but in large part the book seems to be a compilation of much that is new and some that is old in nursery and planting literature, with care taken to give credit to the source. The task of selecting the best has been well done, in general; but some authors may be unpleasantly surprised to find themselves cited as authorities for statements made many years ago, before the test of time had been fully applied to their ideas or inventions. Also, the practitioner will wonder why the authors have not brought out more sharply the relative value of new proven processes as compared with the old, instead of leaving the student to make up his own mind from the facts and descriptions given. A case in point is the use of the Olson tree bale for shipping nursery stock instead of the crate or box. Sometimes a statement, true enough in itself, loses force for American foresters because of the origin or authority cited. "Recent investigations in Europe clearly prove that variations in the characteristics of the mother tree due to soil and climate may be transmitted through the seed." Certainly this has been proved also by American foresters working with American trees such as Douglas fir from high and from low altitudes in the Pacific Northwest.

The book deals in generous measure with the fundamentals of artificial reforestation without attempting to cover fully the application of those underlying truths for the particular conditions which may confront the planter. It is not a manual. Technique is described fully and well, but the art of management is hardly touched except in three short paragraphs at the end under "Field organization for planting." The growing of the species or crop needed for a particular market is barely mentioned, but much emphasis, apparently reflecting the European authorities studied, is laid on preventing soil deterioration. Costs, when mentioned, are usually given in relative terms, although Korstian states that time figures are given so that any desired wage scale can be applied.

Most experienced foresters will approve the way in which the chimera of exotics is treated. "The extensive use of Scotch pine, Norway spruce, and other European species in restocking forest lands in the eastern United States is, in the authors' opinion, to be regretted. So also the use of eastern hardwoods on the Pacific coast. In none of these regions has any of these species been brought to maturity in forest stands, and the results from such restocking are largely problematical. Often the chief inducements are rapid juvenile growth and low cost of seed and nursery stock." The use of eucalyptus in California is cited as an example of the forest planting of exotics which "have proved of value." Is this irony? If so, it comes as a surprise from Professor Toumey.

Much of the information in this book should be part of the background with which the practicing forester approaches a planting job. For a student seeking to acquire such a background, this text will be of great service. The revision retains the clarity of expression and the forceful statement of demonstrated fact which have characterized Professor Toumey's lectures and writings. Those to whom these dicta seem self-evident should think of their student days. Blessed are those who point out the right road in a strange land. Further, the only practicing forester who will not benefit from reviewing fundamentals is the one who already knows it all; and he, if he exists, will not be practicing long.

One feature unusual for a textbook is the absence of cross-references. Even "as discussed elsewhere" is not used. Such confidence of ability to say all and only the things that need to be said in any one place is begotten only by mastery of the subject. That is one reason for this book's high standing.

Many of the illustrations have appeared, in more or less smudged form, in Forest Service publications. Owing possibly to better paper, possibly to better reproductive processes, in this book they are distinctly more clear. Also, the original photographs have not been cut so closely. The result is that the pictures tell their story better.

[7] J. Wiley & Sons (Inc.), New York.

Management of Spruce Lands in the Northeast

By K. W. Woodward, University of New Hampshire

As soon as the Northeastern Forest Experiment Station was established it became apparent that one of the most urgent problems to be tackled was the question, How can satisfactory second growth be obtained in the mixed stands of northern hardwoods and conifers? The Forest Service itself wanted to know in order to handle its timber sales on the White Mountain National Forest, the pulp companies were crying for the information, and the failure of the ordinary methods of culling was glaringly apparent.

On this problem Marinus Westveld has been working steadily since 1925. He has examined 420 temporary sample plots varying in size from 0.1 acre to a full acre and has established on the White Mountain National Forest permanent plots upon which he is testing his inferences.

Naturally softwoods are the most desirable species in the Northeast. The problem is, in brief, one of

insuring a sufficient supply of spruce and giving it a fighting chance against its competitors. Fortunately spruce reproduces well even under mature trees, so that there is a good supply of advance growth on the ground when cutting takes place. The spruce can not come through in competition with the hardwoods, however, without cleanings. In general Westveld's answer, as set forth in his two bulletins [8] entitled "Suggestions for the Management of Spruce Lands in the Northeast" and "Reproduction on Pulpwood Lands in the Northeast," is: Cut the mature trees clean if the market permits. Otherwise select the bigger trees for cutting. Avoid injury to the advance growth. Come back within 10 years and either cut back or girdle the competing hardwoods.

The percentage of balsam will be greater in the cut-over stands than in the old-growth stands, because balsam reproduces more abundantly than spruce; but you can still have a decent percentage of spruce if you will follow directions.

The result of this study shows that the way to get an answer to a forest problem is to pick a good man and give him time and means to get the facts and work out reasonable hypotheses to explain these facts.

Important Western Browse Plants

By Arthur W. Sampson, University of California

"Important Western Browse Plants" is a well-selected title for a bulletin [9] by W. A. Dayton that has recently been published by the Department of Agriculture; there are indeed many important browse plants. Foresters, landowners, and others have real need for authoritative information concerning the food value of browse vegetation for herbivora and concerning methods of maintaining browse cover, particularly on important watersheds. The author, a taxonomic botanist and forest ecologist, is peculiarly well qualified to bring such information together in usable form. Mr. Dayton and his Forest Service co-workers have had this stupendous work in progress over a period of more than 20 years.

The primary meaning of "browse" is shoots or sprouts, especially "of twigs and stems of woody plants, with their leaves, as cropped (browsed) more or less by domestic and wild animals." Browse is also a generic term applied to shrubs, woody vines, or small trees, whether eaten by livestock or not. Accordingly the number of browse species in the United States is in the thousands. On the national forests alone 1,000 or more species have already been collected, representing 225 genera and 68 families.

Browse vegetation is distributed from sea level to timber line, being most abundant at intermediate elevations where arborescent species grow sparsely. It often occurs in desert regions so abundantly as to give character to the landscape, being enabled to withstand drought through special leaf adaptations, through deciduous foliation at critical periods, and in other ways. Some species endure high alkalinity, others salinity, whereas still others grow in mucky soils or in bogs. Thus the acreage occupied by browse is enormous. In California alone the sclerophyllous browse type, or chaparral, occupies thousands of acres at elevations immediately below the commercial timber belt; and the great sagebrush formation of the Great Basin and Rocky Mountain regions is even more extensive.

Ecologists have classified the browse types of the United States into various formations and associations. The classifications most generally adopted are those of Shantz and Zon, of Harshberger, and of Clements.

Although browse vegetation does not afford as much food or as high a quality of food for livestock as the graminaceous cover, it is enormously important on western ranges, especially during periods of drought. Because it has a deeper and much more extensive root system, its annual yield of leafage and twigs fluctuates less than the forage yield of grasses and other herbs. Browse plants with bland juices are more likely to be cropped than those the sap of which is acid, very bitter, or astringent. Not all the delicate variations in bitterness, however, cause animals to reject plant leafage; and the saline taste characteristic of so many browse species peculiar to alkaline habitats, notably those of the goosefoot family, is generally agreeable to livestock.

The browse feed of the West is largely encompassed in some 24 families and 60 genera. Six families and about 17 genera include poisonous species. Nine plant families are of outstanding importance in their contribution of palatable browse plants. The rose family (Rosaceae), including as it does the mountain-mahoganies and bitterbrushes, is one of the most valuable. On the other hand the legume family, so famous for its herbaceous forage plants, contributes little browse feed. The members of the heath family, likewise, are of low palatability; indeed, many species of azalea, rhododendron, Labrador-tea, and other ericaceous genera are toxic and annually cause rather heavy losses among sheep.

After a brief introduction covering these points, important genera under the respective families are discussed in alphabetical order. Even the genera of the Pinaceae are discussed from the point of view of injury by browsing under conditions of overgrazing. In the discussion of each genus one or more so-called "key" species are treated in some detail, with notes on their distribution. Following this, brief notes are given on other important western species. Finally the browse plants are classified according to uses or properties, into groups such as plants with edible fruits, seeds, and nuts; plants yielding latex (lac, rubber, sugar, etc.); ornamentals; poisonous species; and outstanding genera and species of habitat indicators. The illustrations are

[8] Published by the U. S. Department of Agriculture as Circular 134 and Technical Bulletin 223, respectively. Copies can be obtained free of charge, as long as the supply lasts, from the Office of Information, U. S. Department of Agriculture, Washington, D. C.

[9] U. S. Department of Agriculture Miscellaneous Publication No. 101. Copies may be obtained free of charge, so long as the supply lasts, from the Office of Information, U. S. Department of Agriculture, Washington, D. C.

largely pen-and-ink drawings, all but two of which were made by the well-known artist Mrs. A. E. Hoyle. The publications cited are numerous and well selected.

This bulletin may truly be said to mark an epoch in the study of browse plants. It might have been somewhat more useful had there been a fuller table of contents. The too brief table of contents which it includes is, however, largely supplemented by an elaborate index that is indeed a check list of the genera.

To those interested in browse vegetation chiefly as cover to prevent erosion the bulletin is likely to be disappointing; it discusses such subjects as soil-binding characters, root-system network, etc., only incidentally. Also, less space is given to the life histories of important species than I had anticipated. There remains now the big task of determining the relative nutritive qualities of important species of the various browse types at different intervals during the browsing season, and the physiological reactions of these important plants to different seasons of use and intensities of use. That task must enlist the interest of many scientific agencies. In the meantime Important Western Browse Plants will fill a long-felt need of foresters, range technicians, and stockmen.

Plasticity of the Root System of Corsican Pine in Early Life

By J. H. Priestley, University of Leeds, England

(From Forestry, the Journal of the Society of Foresters of Great Britain, June, 1931)

The Plasticity of the Root System of Corsican Pine in Early Life, an interesting paper by R. N. Aldrich-Blake, includes the results of studies in progress since 1923, but such is the complexity of both the practical and scientific problems involved that the results, though very valuable and suggestive, can only be regarded as preliminary.

The Corsican pine has proved very difficult to establish in plantations in Great Britain, so that the author has taken up, for the Forestry Commission, an intensive study of the behavior of the root system of the seedling under various conditions of growth in the nursery or when sown directly in the plantation.

We know as yet very little about the morphology of the root system of the tree, and the section of the paper dealing with this problem makes a distinct contribution in a field of work which is necessarily very laborious and time-consuming. Of recent years data on these subjects have been accumulating, especially in horticultural literature (see, for instance, V. A. Kolesnikov, on the root system of fruit trees, Journal of Pomology and Horticultural Science, viii. 197–209, 1930), and every new contribution only deepens the impression that fundamental studies on these lines will give most help in the end in dealing with many practical problems.

An interesting point is suggested by the ingenious study in this paper of the order of appearance of successive root primordia. They appear, of course, in acropetal order, but, in a tetrarch root, the next lateral apex to emerge is not usually found opposite the preceding one but more usually emerges opposite one of the adjacent protoxylem groups. When lateral root meristems emerge, therefore, they do not obey Hofmeister's rule, which seems to be the fundamental developmental procedure governing the successive emergence of leaf primordia at a shoot apex. The laws governing leaf emergence are the subject of a vast literature; this paper underlines the significance of our lack of knowledge about the emergence of root initials, as it would appear that, if the upper inches of the taproot system were better furnished with vigorous secondaries, bearing in their turn a crop of vigorous tertiaries, most of the problems in the way of establishing the Corsican pine would vanish.

The author distinguishes very clearly between four different types of roots or root regions: (1) The tap root or radicle; (2) mother roots, usually diarch, relatively short and freely clothed in branches; (3) pioneer roots with expanded stele, more groups of protoxylem and with vigorous elongation growth at the expense of aborted branches; and, lastly, (4) small branches dichotomizing early into monarch rootlets heavily infected with mycorrhiza. The "pioneering" habit carries a large part of the root activity in this tree down to unexpected depths at an early age. Sowing in the plantation having so far proved a failure, the success of transplantation seems likely to depend upon keeping the root system of the slower growing "mother root" type well endowed with branches. Root pruning in the nursery bed was attempted, cutting either the tap root or the secondaries, and the results may be slightly beneficial in the production of additional branches. The reviewer has seen this plan of cutting the tap root in regular use by Mr. Corbett, the forester to the Pacific Lumber Co., in his nursery of redwood (*Sequoia sempervirens*) at Scotia, Calif. Careful observations in the Corsican pine seem to show definitely that the value of transplanting is not to be attributed to the production of more branches in the upper part of the root system, although undoubtedly transplanting means very rigorous destruction of the lower part; the success of the process undoubtedly lies in the salutary check given to shoot growth, which in view of the slow-growing habit of the seedling in transplantation, is not the most desirable way to bring about its survival if others could be found. The author has tried the effect of humus and also of nitrogen fertilizers in the nursery, but though more vigorous growth of seedlings is thus obtained, root growth gains in root length not in number of secondaries and short absorbing branches useful when transplanting.

The whole problem affecting the type of root growth in the plant is very fascinating. Many observations, in addition to those of Brenchley and Jackson, which are quoted, draw attention to the existence in the same plant of two types of root, one branching freely, the other of different growth habit and unbranched. In

Thladianthus and in some monocotyledons the unbranched region has a dilated stele and is generally thickened, whilst the narrow root regions branch freely.

In the strawberry and the apple, the different types are formed at different seasons; in fact, many horticultural observations stress the significance of these different types of root. The author seems inclined to think that the addition of any other mineral nutrient might be expected, like nitrogen, to favor shoot growth relatively to root growth, but in view of some of the recent horticultural experience with cultures of fruit trees, potash and phosphate manures might prove worthy of trial in the nursery.

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U. S. GOVERNMENT PRINTING OFFICE: 1931